POWER PLANT ENGINEERING

THE PLANT ENGINEERING AND MAINTENANCE MAGAZINE FOR EVERY INDUSTRY

In This Issue

Stopping Steam Turbine Accidents
Industrial Plant Architecture and Engineering
How and Why of Flow Meter Practice
Heat Economy in Hotels

Circulation This Issue—20,400

OCTOBER
1942

"We'll keep 'em coming—you

Accurate reaming of nozzles has an important bearing on turbine efficiency.

Dynamic balancing makes a smooth running turbine.

Disk has just been shrunk on shaft and is being checked for alignment.

Elliott men always did take pride in building good turbines.

Today, there is additional incentive to build good mechanical drive turbines, and also to build more of them, and *faster*. By the hundreds they are going out to powder plants, ordnance plants, refineries turning out high-octane gas and butadiene, to synthetic rubber plants, plants turning out aluminum and magnesium — in fact, to every industry which is straining to produce more of the things so urgently needed to implement our fighting forces.

We're building good turbines. When they leave our hands, they are well equipped to serve the war effort efficiently and dependably, 24 hours a day. We suggest you can do your part by treating them well, give them the benefit of proper inspection and intelligent operation.

We'll keep 'em coming — you keep 'em turning!

Elliott Company's line of mechanical drive turbines covers practically the complete range of required sizes, for steam conditions up to 600 lb. gauge and 750° F. Gears, built-in or separate, when required. Single-stage and multi-stage designs. We also build all-Elliott turbine-generator units from small sizes to around 10,000 Kw. Bulletins available on all these units. Write.

ELLIOTT COMPANY

Steam Turbine Dept., **JEANNETTE, PA.**

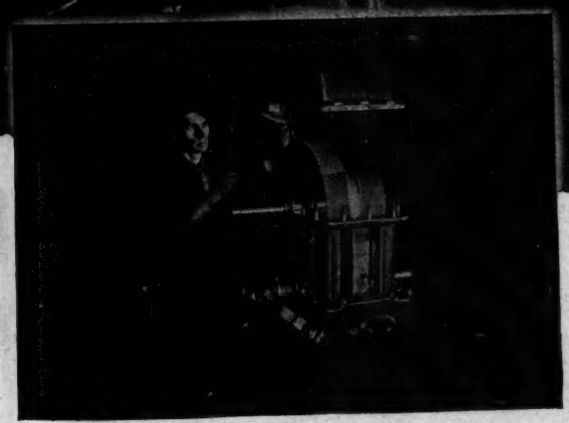
DISTRICT OFFICES IN PRINCIPAL CITIES

H-660

ELLIOTT *Mechanical*

keep 'em turning!"

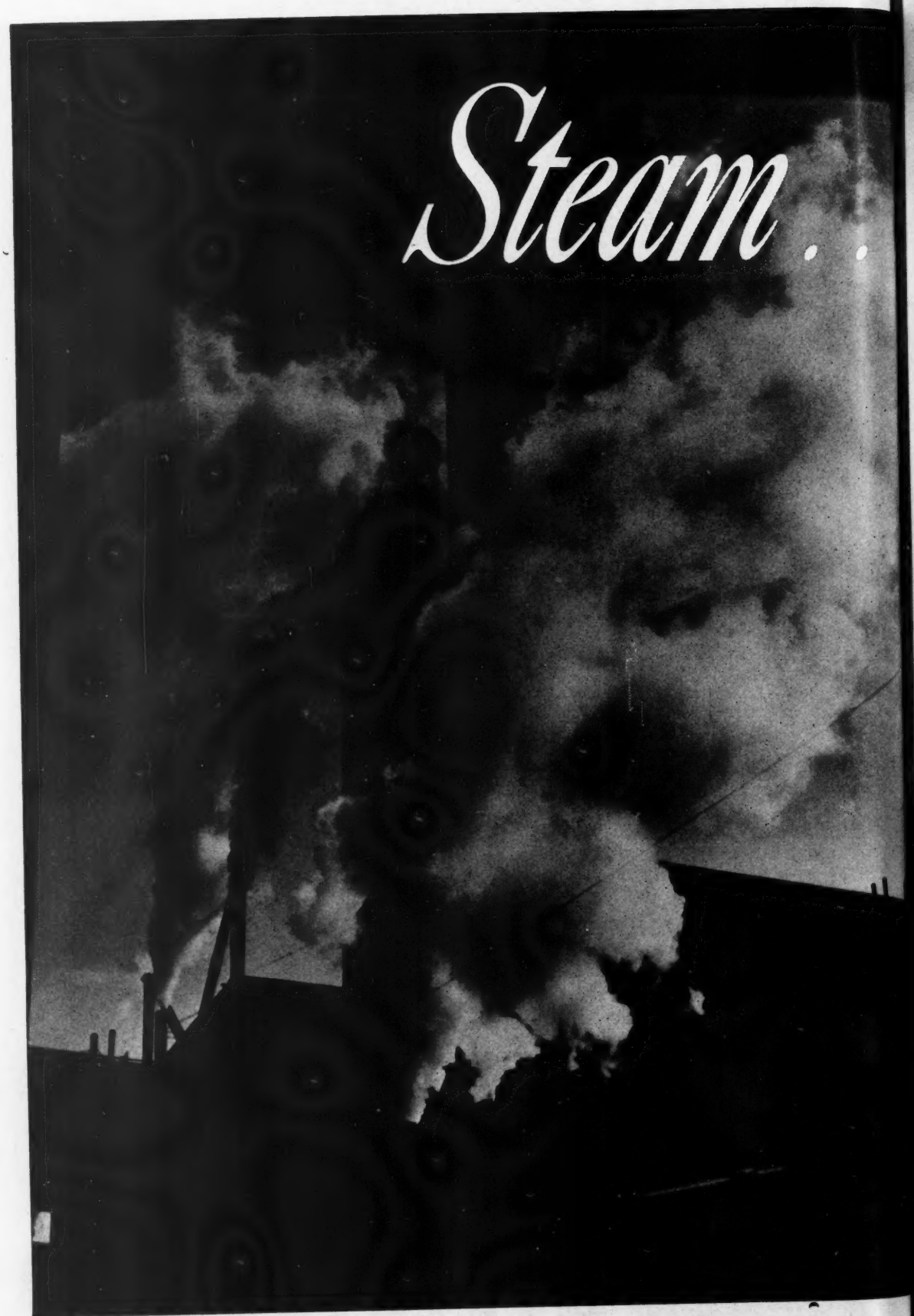
Water Brake Test



Vertical offset speed-reduction gear.

Assembling small single-stage turbine.

ca Drive TURBINES


Steam . .

the lifeblood of America's War Effort

Here is how Hagan can help you <u>at once</u> to obtain maximum steam output

OF all the advantages that Hagan Automatic Combustion Control offers you . . . increased efficiency, constant steam pressure, proper distribution of load among boilers . . . none is so important to you today as the fact that it assures you of *maximum steam output per pound of fuel.*

Regardless of other means of increasing boiler capacity, Hagan Control, of itself, will *increase steam output directly* by giving you:

MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM UTILIZATION value, uniform steam pressure and temperature, in accordance with demand.

MAXIMUM OUTPUT from boilers of differing capacities, automatically.

MAXIMUM STEAM for production, by reducing loss of steam in frequent soot-blowing.

MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

The plant prepared for maximum efficiency today is the plant prepared for maximum economy tomorrow. Write or wire today for a Hagan engineer. He'll come at once.

HAGAN CORPORATION
HAGAN BUILDING
PITTSBURGH, PA.

SPECIFIC ADVANTAGES OF HAGAN AUTOMATIC COMBUSTION CONTROL

Simplicity of operation.
Ease of installation.
Ruggedness of equipment.
Sensitivity to small load changes.
Accuracy of adjustments for small variations.
Speed of movement, with stability, throughout operating range.
Flexibility in meeting individual plant conditions.
Engineered by the pioneers and leaders in automatic combustion control.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

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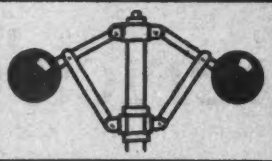
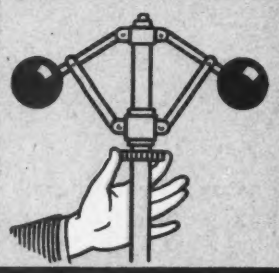
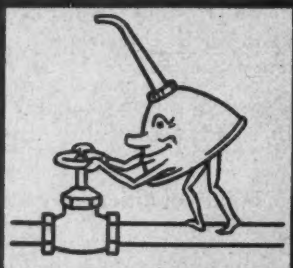
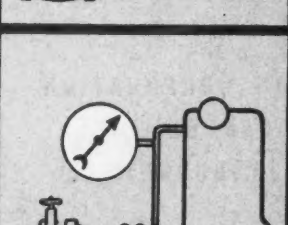
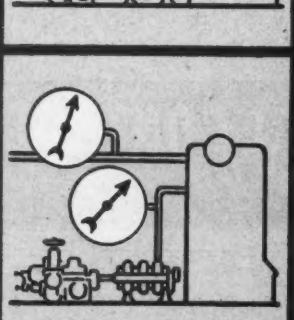
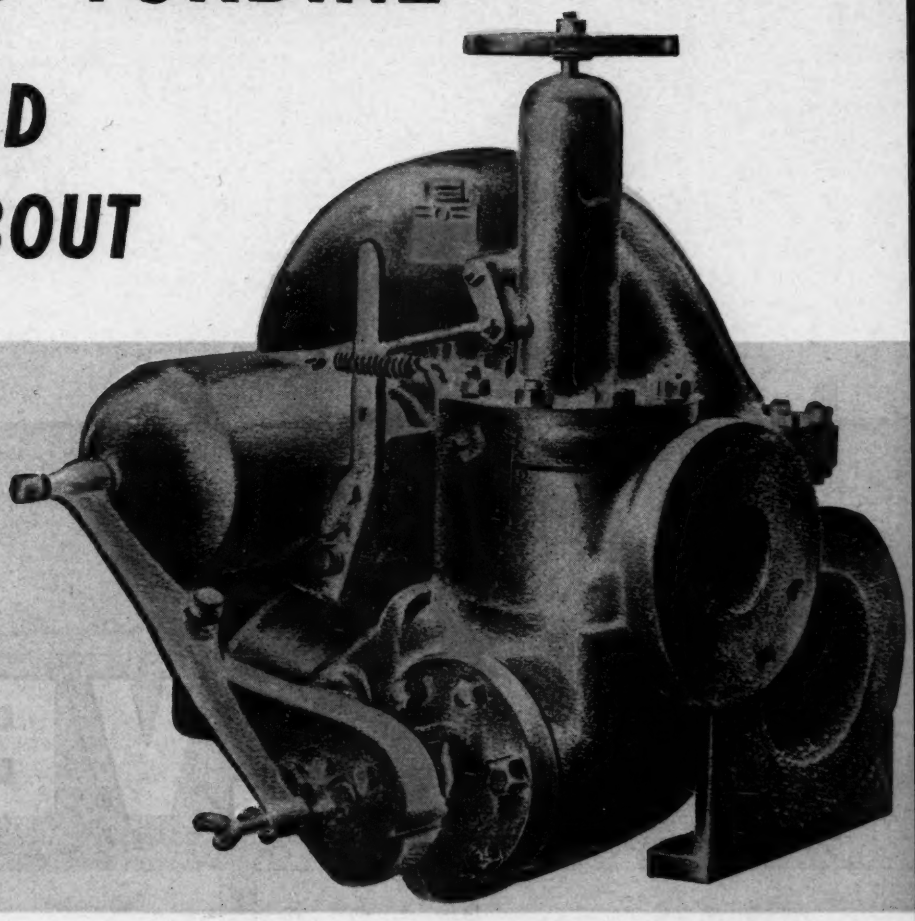
If it's ADJUSTABLE SPEED CONTROL *you want...*

GENERAL ELECTRIC TURBINE GOVERNORS		SPEED ADJUSTMENT	REGULATION NO LOAD TO FULL LOAD	
CENTRIFUGAL-WEIGHT GOVERNOR		0	6%	With this type, the turbine speed is controlled by a horizontal, centrifugal-weight governor mounted on the end of the rotor shaft and connected through a linkage to the double-seated governor valve. In response to changes in speed, the weights travel in or out to open or close the valve. Knife edges and contact surfaces in this mechanism are hardened to reduce wear and minimize friction.
CENTRIFUGAL-WEIGHT GOVERNOR WITH HAND SPEED CHANGER		−10% +10%	6%	A hand speed changer can be built into the linkage of the centrifugal-weight governor described above. This varies the effective length of the valve stem to provide speed range by manual adjustment. It is always required on dual-drive applications to equalize the turbine speed with the motor speed.
DIRECT-ACTING OIL GOVERNOR		−66%	8 TO 20%	A shaft-driven, gear-type pump supplies oil direct for governing. Regulation is 8 per cent at maximum speed and 20 per cent at reduced speed.
OIL-RELAYED GOVERNOR		−10% +10%	4%	Where large valves must be controlled or where speeds are above 5000 rpm, oil-relayed governors are recommended for closer, more accurate speed control. The governor itself operates only a small pilot valve which relays the action of the governor to the governor valve. The governor acts as an indicator of the speed and supplies the small force necessary for operation of the pilot valve.
CONSTANT-PRESSURE REGULATOR		AUTOMATIC AS REQUIRED		Pump discharge pressure is piped to the diaphragm of a pressure regulator which directly regulates the governor valve on the turbine. The speed of the turbine is automatically adjusted to obtain a constant discharge pressure from the pump.
DIFFERENTIAL-PRESSURE REGULATOR		AUTOMATIC AS REQUIRED		This pressure regulator is equipped with two diaphragms—one piped to the pump discharge and the other to the boiler. The governor valve is controlled in terms of the difference in pressure on the two diaphragms. The differential-pressure regulator automatically adjusts the turbine speed to maintain pump pressure at a predetermined value above the boiler pressure.

Here's the TURBINE YOU SHOULD KNOW ABOUT



NO one—industrial or utility—who is increasing capacity can afford to overlook the adaptability of mechanical-drive turbines to a wide range of speeds. Because turbines can always operate at the *right* speed, plant efficiency goes up, and drive costs go down. A turn of the hand speed changer sets the "ideal" speed; or, sensitive diaphragms automatically control discharge pressure on pumps and fans over the entire range of variations in steam pressure.

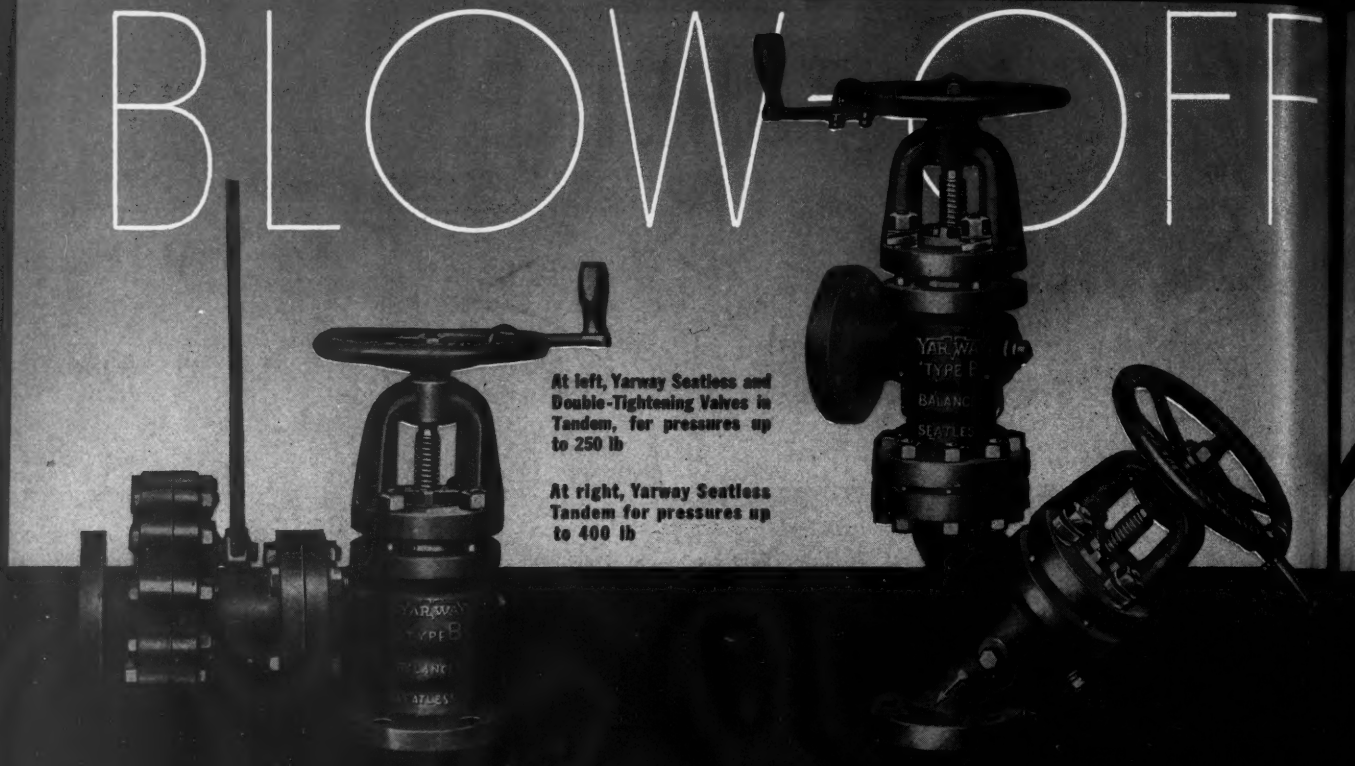
Every Type D mechanical-drive turbine is equipped with two types of governors—overspeed and operating—that function separately and independently. When speed becomes excessive, a through-bolt, spring-loaded, unbalanced weight strikes a trip device to instantly close a built-in combined trip and throttle valve. During normal operation the turbine speed is controlled by the operating governor, which makes use of a small variation in the speed being controlled or of a change in the controlled pressure acting on a diaphragm. G-E speed and pressure governors have a regulation just broad enough to assure stability. What's more, each type is designed to meet a particular set of requirements as to speed range, regulation, and operating characteristics.

Because of their long and intimate experience with tough turbine-governing problems in many industries and utilities, G-E turbine specialists are good men to know. To get their help, all you have to do is call our nearest office, or write General Electric, Schenectady, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

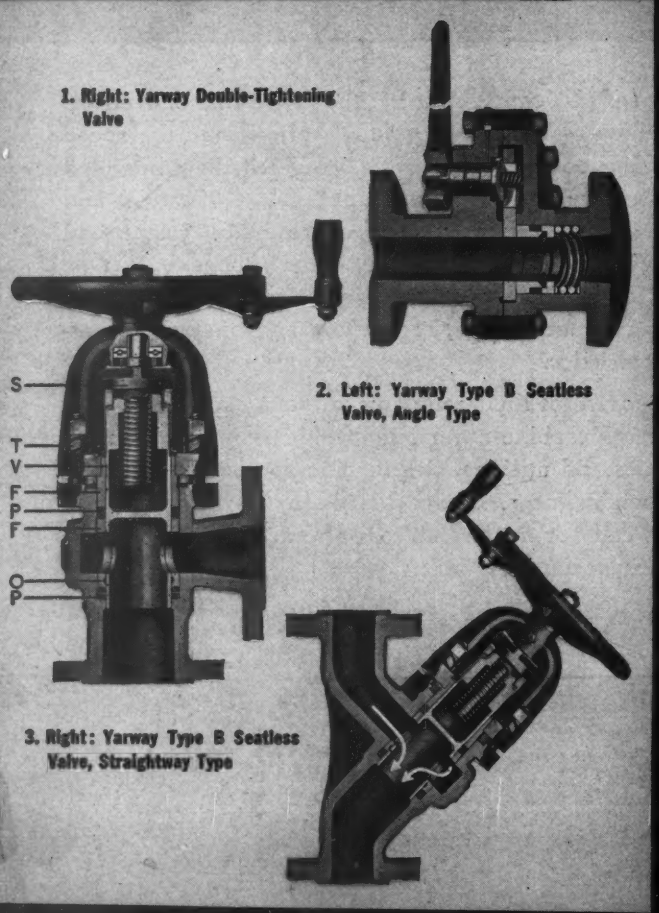
BLOW-OFF



At left, Yarway Seatless and Double-Tightening Valves in Tandem, for pressures up to 250 lb

At right, Yarway Seatless Tandem for pressures up to 400 lb

FOR EVERY



1. Right: Yarway Double-Tightening Valve

2. Left: Yarway Type B Seatless Valve, Angle Type

3. Right: Yarway Type B Seatless Valve, Straightway Type

Yarway offers a complete Blow-Off Valve Service—FOUR DISTINCT TYPES OF VALVES to answer the Blow-Down Requirements of every steam plant.

Each is the product of more than a quarter-century of mechanical and metallurgical research—of practical field experience with more than 12,000 installations—of a determination continually to lead the Industry with the finest blow-down equipment that can be produced.

Because the Yarway line is complete you may be sure Yarway recommendations will be unbiased, based on honest judgment that the type of valve selected will give long, trouble-free, money-saving service on the job.

Write for catalog; For pressures up to 400 lb, Section 421; For higher pressures, Section 431.

YARNALL-WARING COMPANY
114 Mermaid Ave. Philadelphia

YARWAY

VALVES

At left, Yarway Seatless Tandem for pressures up to 900 lb

At left, Yarway Unit Tandem —a Seatless and Hard-Seat Valve combination using one common forged steel body. For pressures up to 1500 lb

PRESSURE

arway Double-Tightening Valves (Fig. 1) are of lever-operated swing gate design with unique feature of sealing bushing on inlet side, making valve double-tightening on both sides of disc. When open there is a straight through passage for unobstructed flow.

•

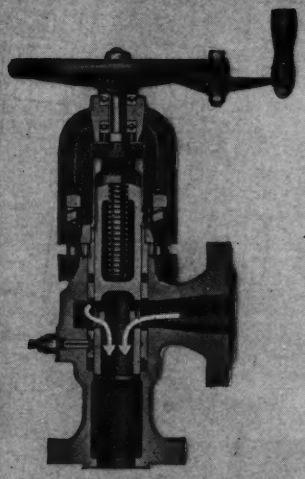
arway Type B Seatless Valves are of balanced, sliding plunger design. Made in Angle (Fig. 2) and Straightway (Fig.) Types. Operation of Yarway Seatless Valves: After valve is closed, shoulder S on plunger V contacts with upper follower and F, forcing it down into body and compressing packings above and below port, making an absolutely tight valve. oke springs T maintain continuous pressure through follower glands F, on packing rings P. Annular groove O connects with alemite fitting for lubricating plunger and packing; lemite lubrication also provided for stem.

•

arway Type C Seatless Valves (Fig. 4) are made in both angle nd straightway types. In this design the longer plunger rotects the packing from blow-down at all times. Other eatures are laminated packing with stainless steel inserts, tralloy plungers alemite lubrication, ball thrust bearings.

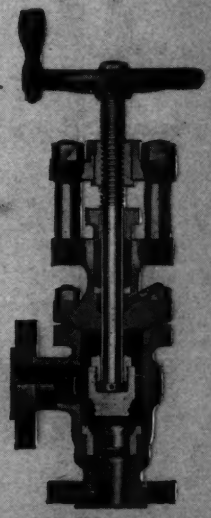
•

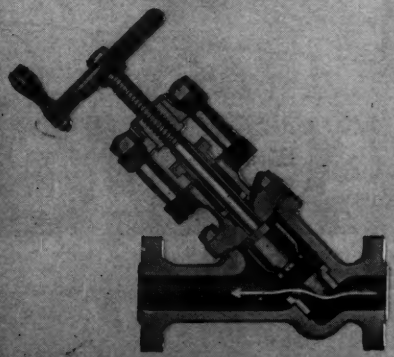
arway Hard-Seat Blow-Off Valves are of cone seat and disc ype, having metal-to-metal contact. These valves are made angle type (Fig. 5) and straightway easy flow type (Fig. 6). eatures of the Yarway Hard-Seat Valve include: Marine and ast steel type yoke with threaded bushing, packing gland ith bronze liner, large packing space, long-shank stem. isc and seat ring are stainless steel; beveled faces have ellite inserts which provide smooth, hard-wearing surfaces this important point.



4. Above: Yarway Type C Seatless Valve, Angle Type

5. Below: Yarway Hard-Seat Valve, Angle Type

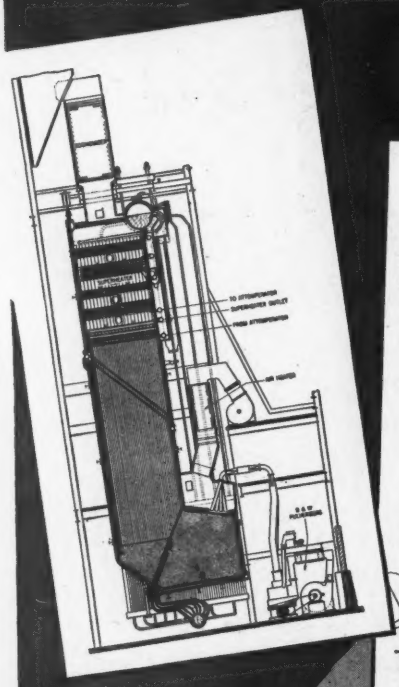


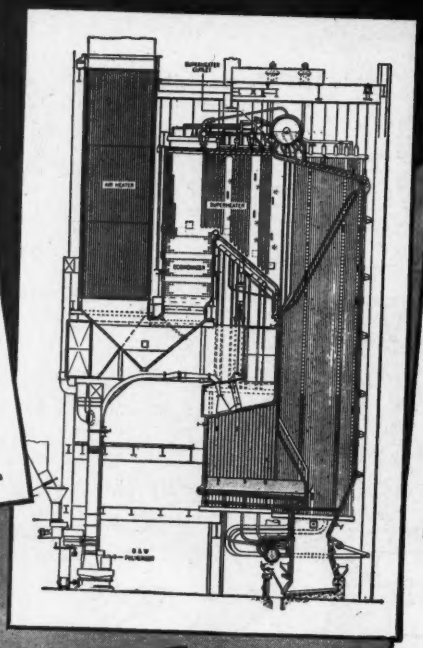


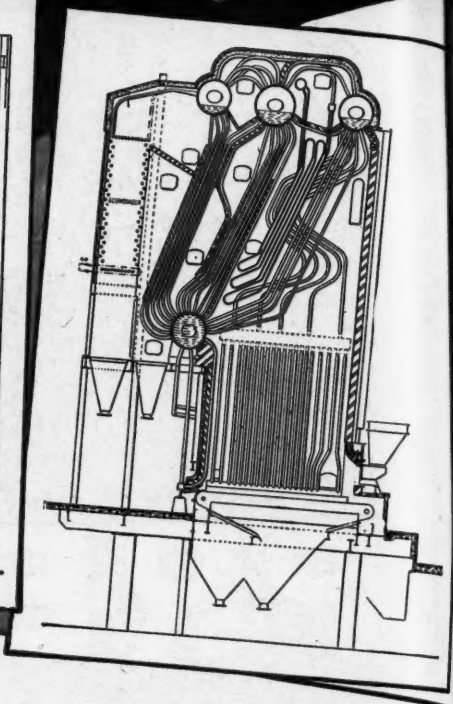
6. Left: Yarway Hard-Seat Valve, Straightway Type

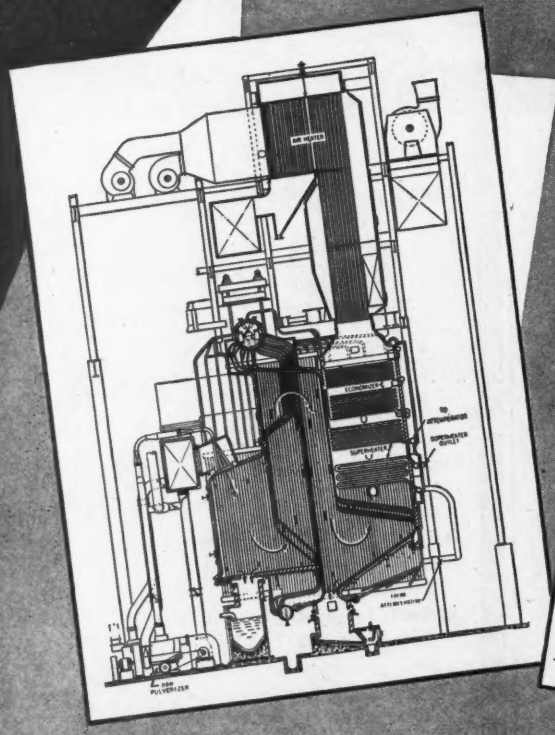
BLOW-OFF VALVES

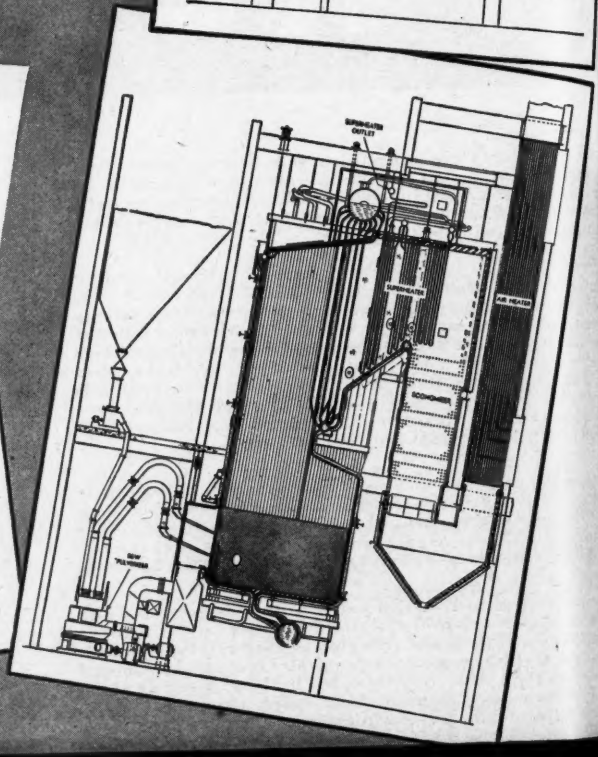
B & W Designs











BABCOCK & WILCOX

meet all Requirements

of modern water-cooled furnaces

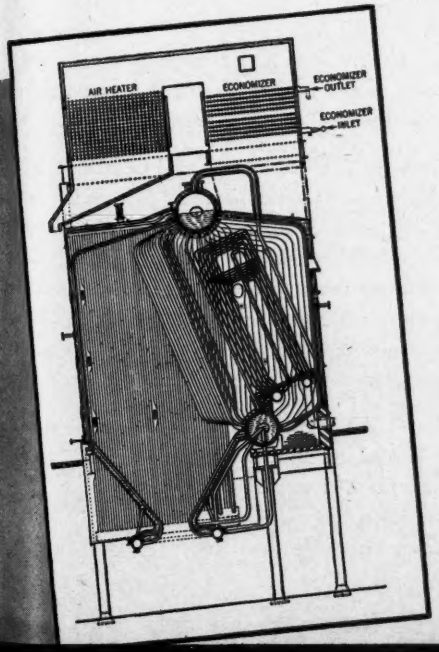
Water cooling must not only operate under a wide range of load and structural conditions (as illustrated by the typical settings shown) but also must serve many entirely different purposes in individual boiler furnaces.

Some areas of water-cooled furnaces are designed to promote combustion—others, to temper gases. Frequently heat input must be limited—sometimes radiant heat must be absorbed rapidly. Some constructions must facilitate removal of ash in liquid form—others must condition ash for ease of removal in the dry state.

Obviously no single type of water-cooled construction can be used successfully for all present-day boiler-furnace conditions and purposes.

B&W water-cooled furnace constructions have the diversity necessary for meeting all these demands and their range of applications is sufficiently broad to fit every requirement. Fundamental details and safety factors necessary to proper operation and efficiency are common to each type.

The Babcock & Wilcox Company — 85 Liberty St., New York, N. Y.

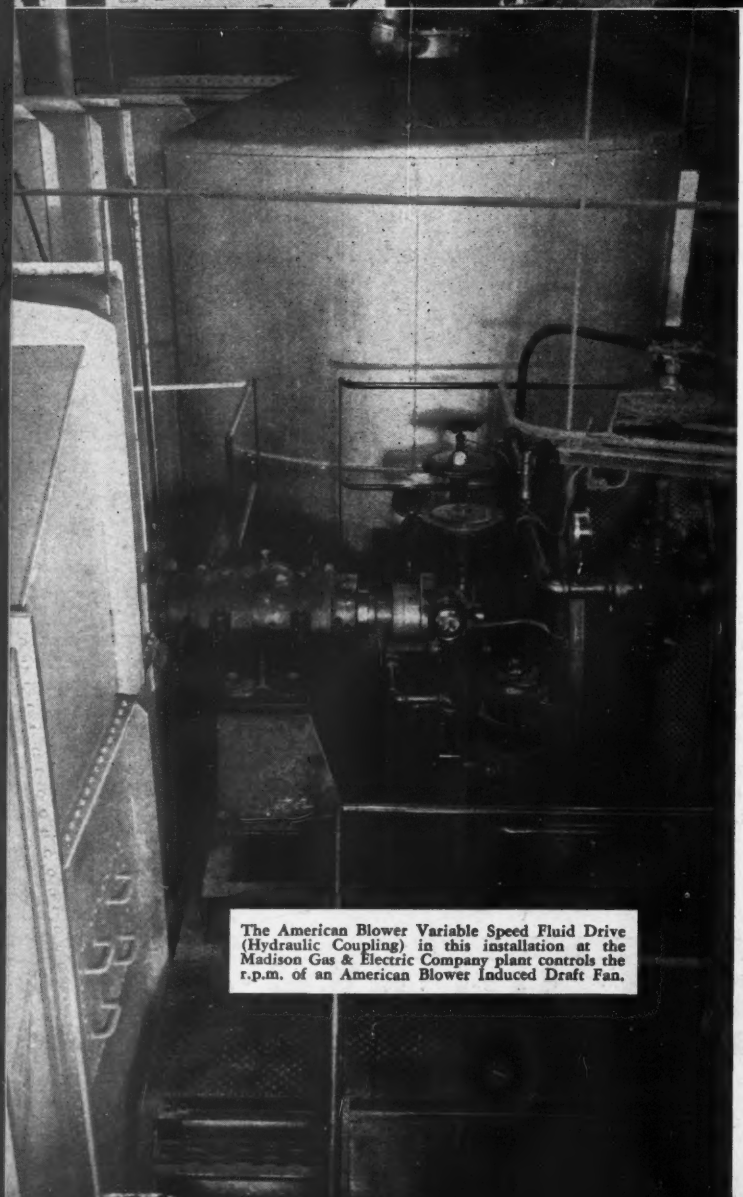


This booklet upon request

We will gladly send you a copy of Bulletin G-16, Water-Cooled Furnaces. It shows many typical boiler furnace designs; illustrates seals, wall supports, headers, studded tubes, and other features; tells of important requirements for water cooling; describes typical constructions.

G-233-T

WATER-COOLED FURNACES



The American Blower Variable Speed Fluid Drive (Hydraulic Coupling) in this installation at the Madison Gas & Electric Company plant controls the r.p.m. of an American Blower Induced Draft Fan.

. . . AND ON, MADISON—Capital and University City of Wisconsin! Madison is going ahead — fast, doubling its population between 1900 and 1920, and again between 1920 and 1940. Madison's more than 66,000 residents are rightly proud of their city—their university, schools, industries, libraries, hospitals, parks and lakes. They're proud of the million-dollar U. S. Forest Products Laboratory — first in the world. The people of Madison, and the 17,000 students who make Madison their home every year, take just pride, too, in the Utility which dependably supplies the electric power so essential to the life, health and happiness of this beautiful, progressive community.

THE MADISON GAS & ELECTRIC COMPANY is in step with progress — consistently improving and expanding its facilities to serve its customers better with vital electric power at reasonable cost. And American Blower takes pride in the knowledge that American Blower Mechanical Draft and Fluid Drive (Hydraulic Coupling) equipment is dependably functioning as a part of this modern system.

IF YOU HAVE ANY PROBLEM involving the application of Forced or Induced Draft Fans or Fluid Drives (Hydraulic Couplings), phone or write the nearest American Blower branch office.

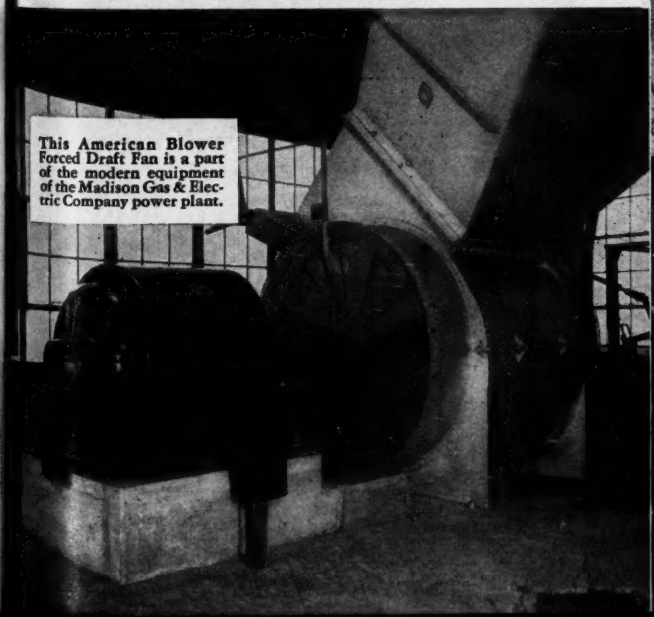
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO
Division of American Radiator and Standard Sanitary Corporation

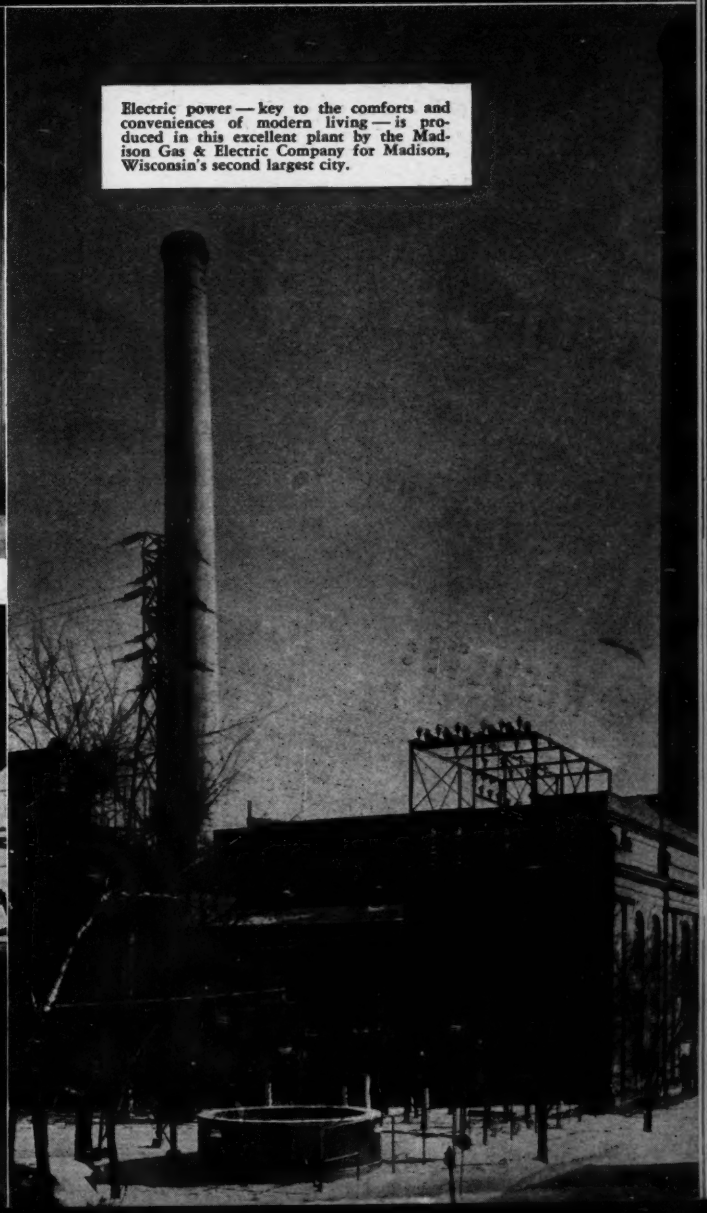
CONSIN!

F THE MADISON GAS & ELECTRIC COMPANY

The Madison Gas & Electric Company's Office Building and Display Rooms.



This American Blower Forced Draft Fan is a part of the modern equipment of the Madison Gas & Electric Company power plant.



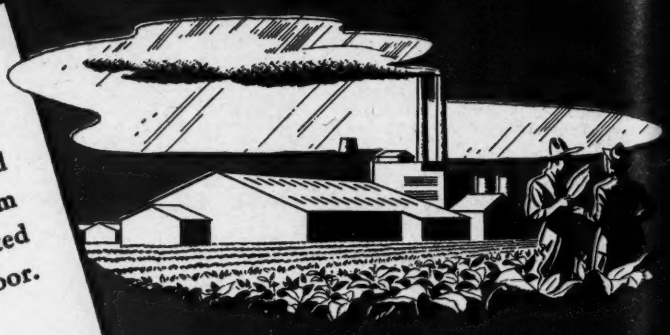
Electric power — key to the comforts and conveniences of modern living — is produced in this excellent plant by the Madison Gas & Electric Company for Madison, Wisconsin's second largest city.

WHEN PERFORMANCE COUNTS YOU CAN COUNT ON A-E-CO TAYLOR STOKERS

A CASE IN THE TOBACCO INDUSTRY

PROBLEM:

The situation at this plant was unusual. Firing equipment had to be selected which, burning the widest range of coals economically available, would operate at maximum efficiency with a minimum furnace volume. The existing plant was of limited height and had no basement below the firing floor.



SOLUTION:

Upon due consideration of the requirements, a Taylor Continuous Ash Discharge Stoker was installed under a 70,000 lb. per hour steam generator. No heat recovery equipment was purchased.

RESULTS:

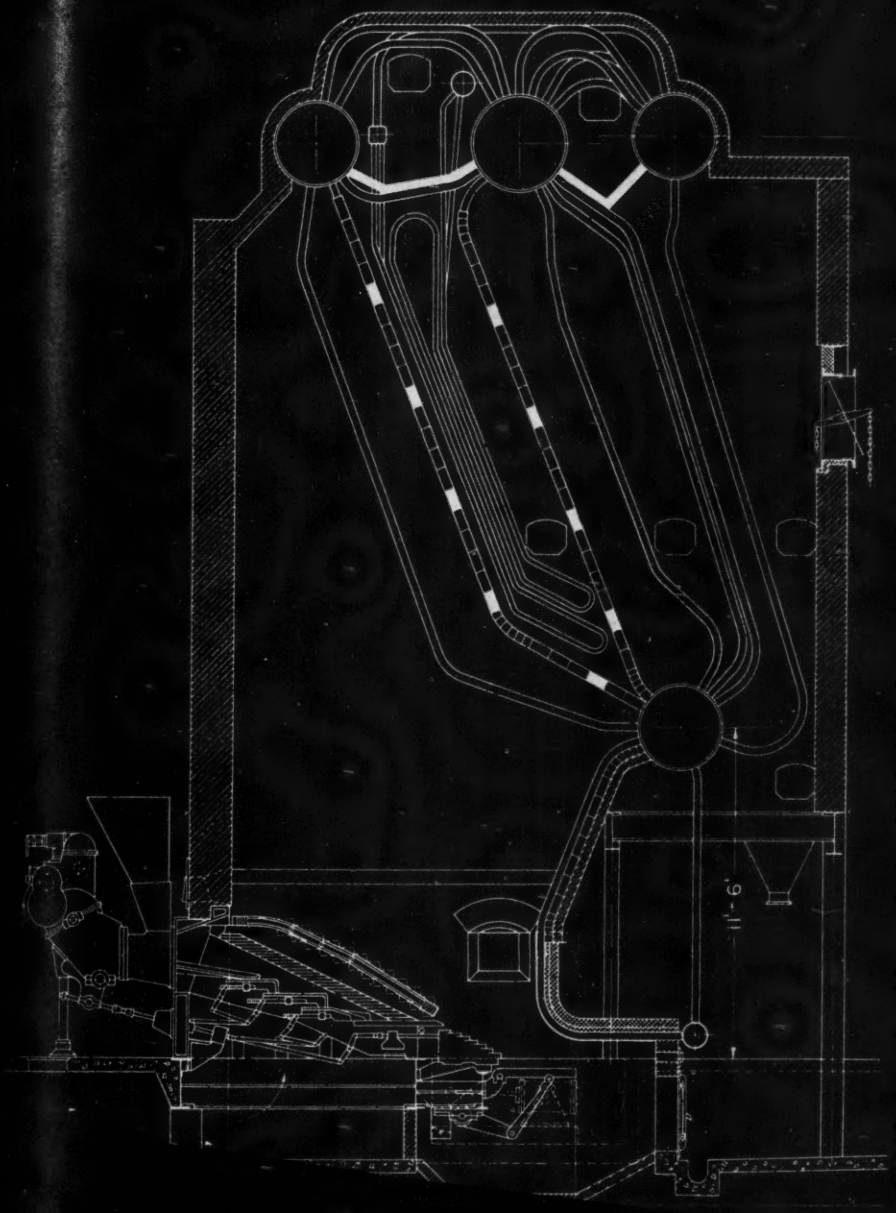
The unit was placed in service March 24, 1940. A recent report on performance from that date until April 30, 1942 disclosed 442,884,000 lbs. of steam generated from 45,311,280 lbs. coal (average evaporation; 9.77 lbs. steam per lb. of coal). The coal contained an average content of 13,890 B.T.U. per lb. as fired. Operating conditions; 410 lbs. pressure, gauge; 650°F. total steam temperature; 277°F. feed temperature to boiler. The combined efficiency of the unit was 79.9%. It is interesting to note that the unit was in service 17,448 of the elapsed time of 18,432 hours, or available 94.6% of the time.

CONCLUSIONS:

This case demonstrates two important advantages of the Taylor Stoker—its ability to burn a wide range of coals economically and the ease with which it can conform to limitations of space. By eliminating the need of new construction, the space advantage of the Taylor Stoker contributes to conservation of essential materials.

AMERICAN ENGINEERING

PHILADELPHIA



A-E-CO TAYLOR STOKER

BEFORE YOU BUY ANY FUEL FIRING EQUIPMENT CONSIDER EACH OF THESE 12 FACTORS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

The TERRY

TERRY
SOLID WHEEL TURBINE
ADVANTAGES . . .

— The blades and the wheel (see above) are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— As the only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

— The Terry wheel will withstand abuse that would wreck any built up wheel.

THE TERRY STEAM TURBINE CO.

Wheel Turbine

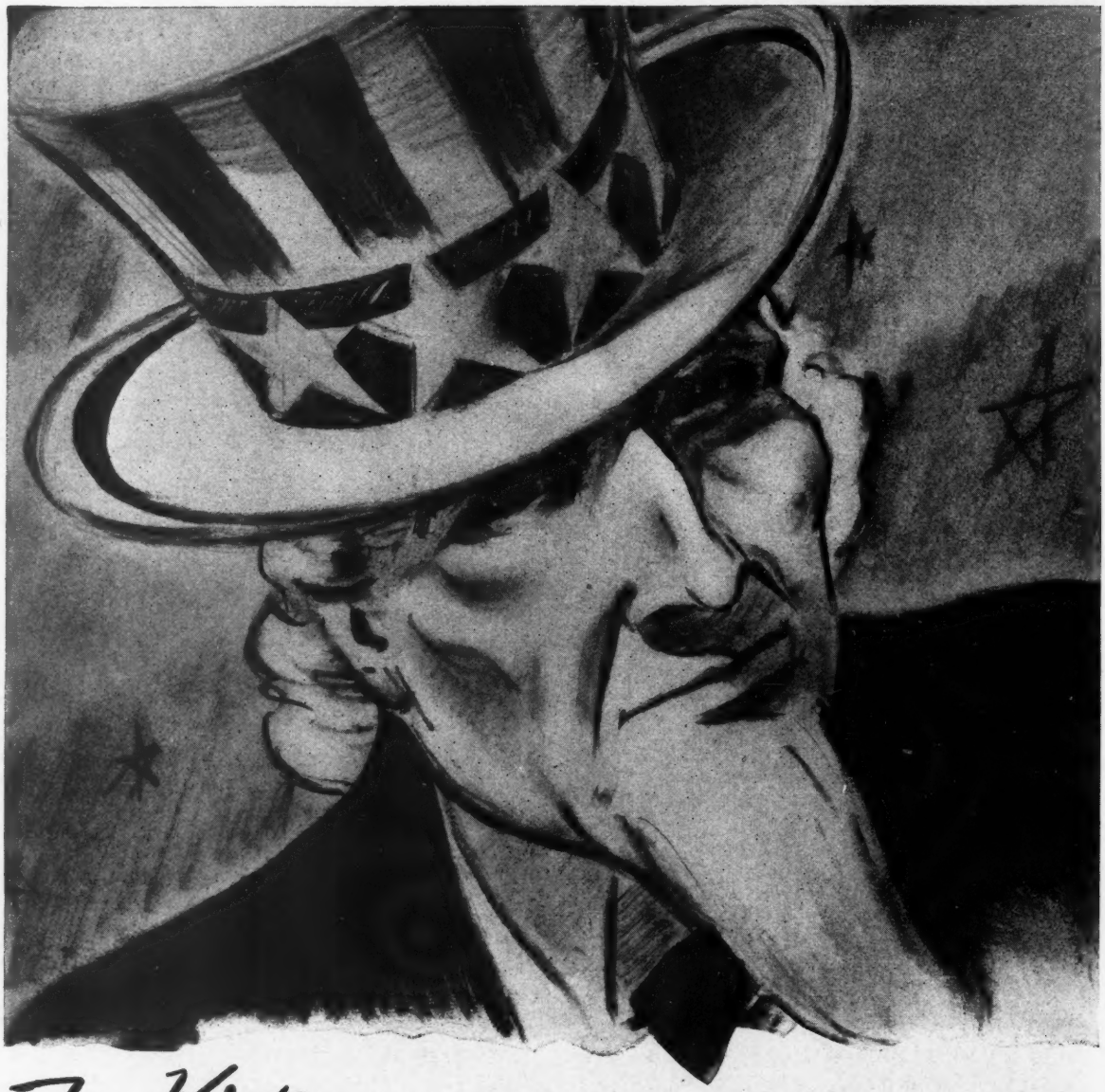
The Terry Solid Wheel Turbine is available in ratings from 5 HP to 2000 HP. It is built for all commercial steam pressures and exhaust pressures. Thousands of them are in daily service in central stations, industrial plants and on board naval vessels.

Full details of the Terry Solid Wheel Turbine will be gladly sent upon request. Ask for Bulletin S-116.

At right—
Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized

T-1147

TERRY SQUARE - HARTFORD, CONN.



For Victory —USE QUALITY MATERIALS

To get the most out of your packings, gaskets and oil seals, insist on *quality* at the start . . . and be sure you use the proper material for each requirement. A Garlock representative will gladly advise you about this.

GARLOCK

THE GARLOCK PACKING COMPANY, PALMYRA, N. Y.
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

For the second time employees of Foster Wheeler have been awarded the "E" for excellence in production. In war, as in peace, the Dansville plant works to but a single standard. The logical result is this citation for distinguished service in the production of quality, in quantity, on time.

The men and women at both plants—Carteret, N. J., and Dansville, N. Y.—have now received the highest honor that our armed forces can confer in recognition of "all-out" efforts in the call of duty.

FOSTER WHEELER

FOSTER WHEELER CORPORATION • 165 BROADWAY • NEW YORK, N. Y.

Do you need more steam right Now?

A Steel Plant installed Enco Streamlined Baffles and increased the output of its boilers 50%

A large steel plant* did need more steam and needed it at once. A new boiler was being considered but involved months of waiting.

A study of the baffles in their four bent tube boilers showed that a change to Enco Streamlined Baffles would add a considerable amount to their total steam output. Enco Baffles were installed at the rate of one boiler per week, and their operating records now show 50% increase in output under usual load conditions. During an emergency test, the full load was carried with two instead of four boilers.

This improvement in capacity was made with no measurable increase in flue gas temperature and for the comparatively small cost of new baffle walls.

With Enco Cross Flow Baffles the entire heating surface is swept by the hot gases. The streamline principle makes a material reduction in the draft drop, producing highly improved efficiency and output of the boiler.

Enco Baffle Walls are correctly designed for either horizontal or vertical bent tube boilers. They are installed by skilled mechanics with the materials shown by years of experience to be best for the purpose.

Write for Bulletin BW-40, "Modern Practice in Baffle Wall Design and Construction," or for quick action send blue print and operating data to learn what we can do for you.

The Engineer Company, 75 West Street, New York, N. Y.

* Name of plant available upon request.

Enco Baffles installed in a Connelly Boiler for a large Packing Company in Canada.

Enco Baffles installed in a Combustion Boiler at an Eastern U. S. Navy Yard.

Enco Baffles installed in Stirling Boiler for a large Pennsylvania Steel Plant.

Enco Baffles installed in Vogt Boiler for a Middlewest Oil Refinery.

Enco Streamline Baffles

If it's WATER CONDITIONING *you need*

—FOR POWER PLANTS OR PROCESS PLANTS

ELGIN *has the answer!*

TODAY'S urgent needs can't wait for investigation of methods or sources of supply. The safest, most economical way to fill your right-now water conditioning equipment requirements is to put your problem before an organization whose reputation is *established.*

Such an organization is Elgin Softener Corporation—a fact that is confirmed by the selection of Elgin Equipment and Services by all branches of the armed forces and by vital war industries. Note the scope of Elgin methods and equipment briefly outlined here. You are certain to get a wholly unprejudiced proposition—based on 35 years of learning and accomplishing—when you put your problem up to Elgin. Recent large-scale expansion means—

Prompt Deliveries for Essential Needs!

ZEOLITE WATER SOFTENERS

• Types cover all wartime requirements and specifications. Line includes Elgin "Double-Check" type which gives up to 44% more capacity; cuts salt consumption 10 to 25%; stops loss of zeolite when backwashing; has self-cleaning action.

DECONCENTRATORS FOR BOILER SLUDGE REMOVAL

• The time-proved Elgin Method of removing scale-forming impurities and suspended matter from your boiler without steam-wasting blow-down. It assures clean boilers—clean steam. Often eliminates need for sedimentation, filters, softeners, and heat exchangers.

SOFTENERS RE-BUILT—MODERNIZED

• Quick increases in Zeolite Softener Capacity can be obtained by Elgin re-building and modernization methods. Improvements include re-filling with high-capacity zeolite; adapting "double-check" principle, backwash controller, "Solo" (single valve) control, etc.

CHEMICAL TREATMENTS

• Individually prepared for specific plant needs and constantly checked by laboratory and field service. Widely used for boiler feedwater, process water, cooling towers, engine jackets, hot and cold water lines, etc.

(Chemical treatments are promptly available from stock, and high priorities are not needed. Also they require no expensive mechanical equipment. Therefore they offer the most expedient solution for the problems to which they apply.)

CONTINUOUS BLOWDOWN HEAT EXCHANGERS

• Controls concentration with minimum heat loss, preventing priming, foaming and wet steam. Recovers useful heat from blow-down.

OTHER ELGIN PRODUCTS INCLUDE:

- **Pressure Sand Filters**
- **Purifiers**
- **Aerators**
- **Oil Removal Filters**

BEFORE YOU BUY
be sure to get
a proposition from
ELGIN

ELGIN SOFTENER CORPORATION
136 North Grove Avenue, Elgin, Illinois
Representatives in Principal Cities

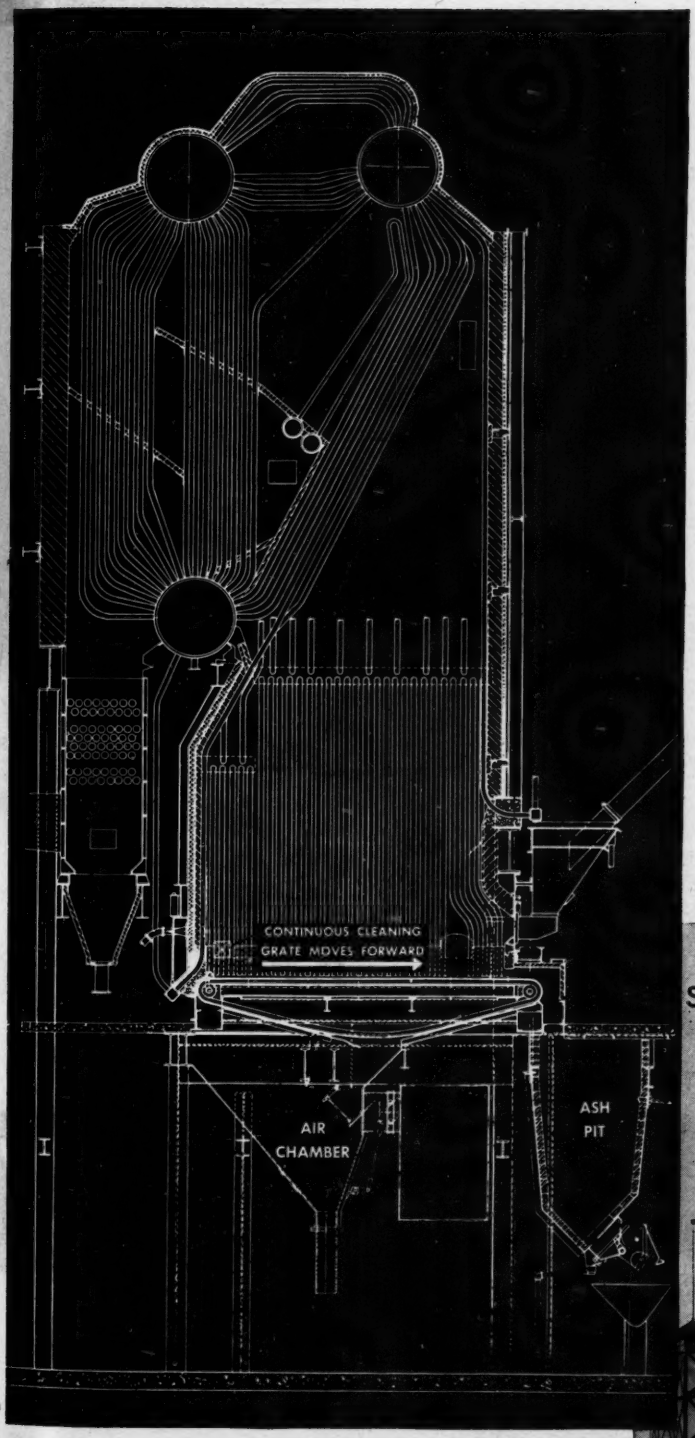
DETROIT ROTOGRATE STOKER

Heating Surfaces	
Boiler	18,800 sq
Water Walls	2620 sq
Economizer	4608 sq

DETROIT ROTOGRATE STOKER

DETROIT STOKER COMPANY

at Studebaker . . .



- In 1940 Studebaker Corporation selected the RotoGrate for Main Plant, South Bend, Indiana.

Reason: The proven ability to burn any available coal at high burning rates.

- In 1941—Eight additional RotoGrate Stokers were installed in three other Studebaker plants.

- This year, R. N. Bucks, Superintendent of Power, reported at Midwest Power Conference, Chicago:

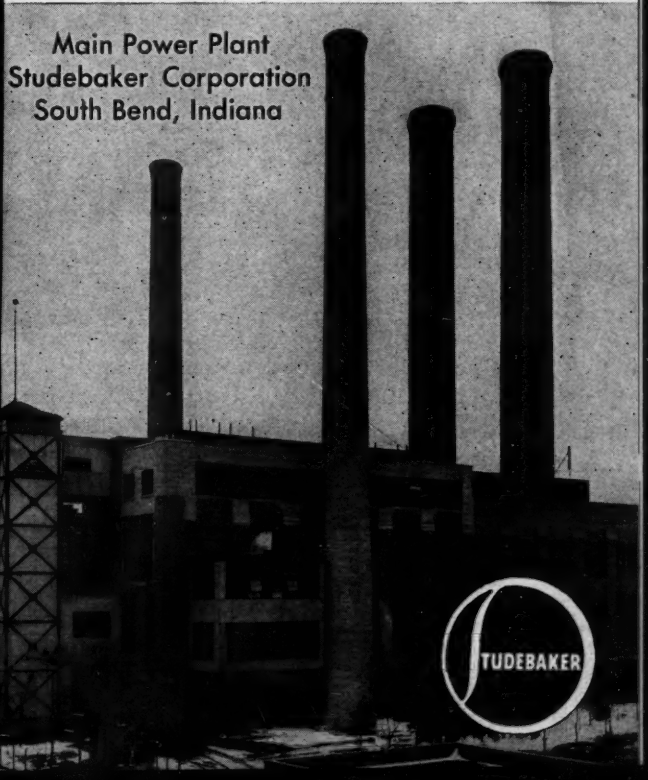
"1. RotoGrate was operated almost continuously since November, 1940, with only six outages of two days each, for general inspection.

2. Over 50,000 tons coal from seven different Illinois, Indiana and West Virginia Mines (raw screening coals 1-¼" by 0) were burned.

3. Average efficiencies for 1941:

Monthly, 80.5% to 84.4%
Annual, 82.4%

4. Load range varies from 35,000 to 225,000 pounds of steam per hour."



Main Power Plant
Studebaker Corporation
South Bend, Indiana

STUDEBAKER

Sales & Engineering Offices
General Motors Building • Detroit, Mich.

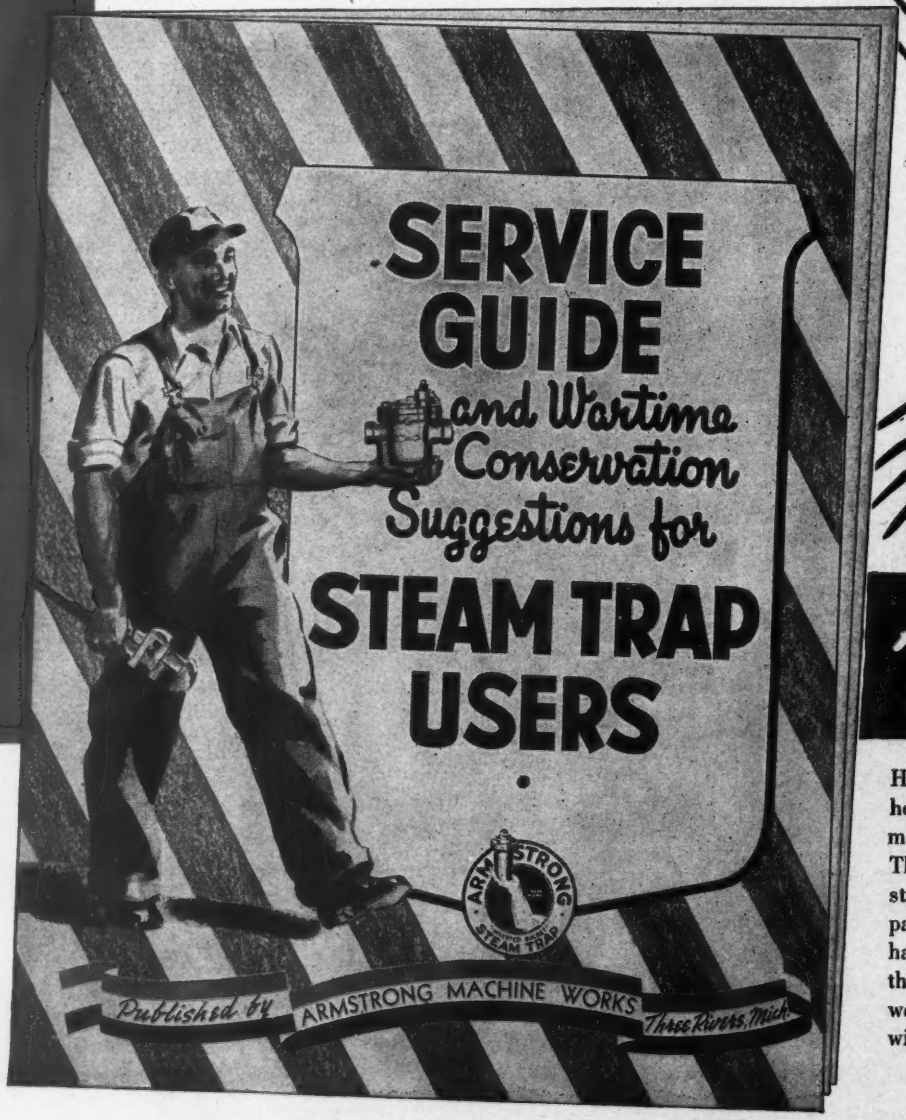
"GUARDIANS OF F

AN ARMY WE CAN ALL JOIN!

WHEN the call of the bugle is loud and the smell of powder is in the air, it's hard for a man to go about his daily toil without longing to get into uniform and lend a hand. But if you are one of the folks who have "jobs to do", remember that once our armies are locked in battle, their last great resource is the efficiency of the production machine at home.

And it's not just a matter confined to direct war work but efficiency straight down the line that counts. Whether your business is making shells or washing clothes, if you can keep your plant going efficiently and well-protected with "stitch-in-time" type of repairs you will be handling your sector of the front with merit.

Wars have a habit of being won by the people who can stick to it the longest. Now is a good time for you to do some reconnaissance on the plant maintenance front. The less ground lost, the easier it will be to support an all-out offensive.



Keep your old traps in **GOOD REPAIR**

A NEW BULLETIN

★ ★ ★ ★

HERE is a new bulletin designed to help plant maintenance men get the maximum life out of their steam traps. The data includes suggestions on installations, testing, inspection, repairs, and "trouble shooting." If you have not already received a copy of this guide, send us your name and we will be glad to mail one promptly without obligation.

EFFICIENCY"

Use GOOD TRAPS *on new jobs!*

ARMSTRONG
TRADE MARK
WHY IS IT YOU SO SELDOM SEE STRAINERS AHEAD OF ARMSTRONG TRAPS?
BECAUSE THEYRE SELF SCRUBBING!
SEE OUR CATALOG IN SWEET'S

NO more metal is required for a good trap than for one ill-suited to the service, and frequently less. Yet, time after time, installations go in that soon have to be replaced simply because the service is too severe. The result is double expenditure of money, metal, and manpower.

Armstrong Traps are built to stand up under the hardest possible service and therefore require very little maintenance on any kind of service. Armstrong furnishes very complete data to make *trap selection* quick, simple, and accurate. In addition, Armstrong traps are backed up by an outstanding group of factory representatives covering every principal industrial center. For complete protection, use Armstrong Steam Traps.

IN TO HELP YOU MAKE YOUR ARMSTRONG TRAPS last even longer

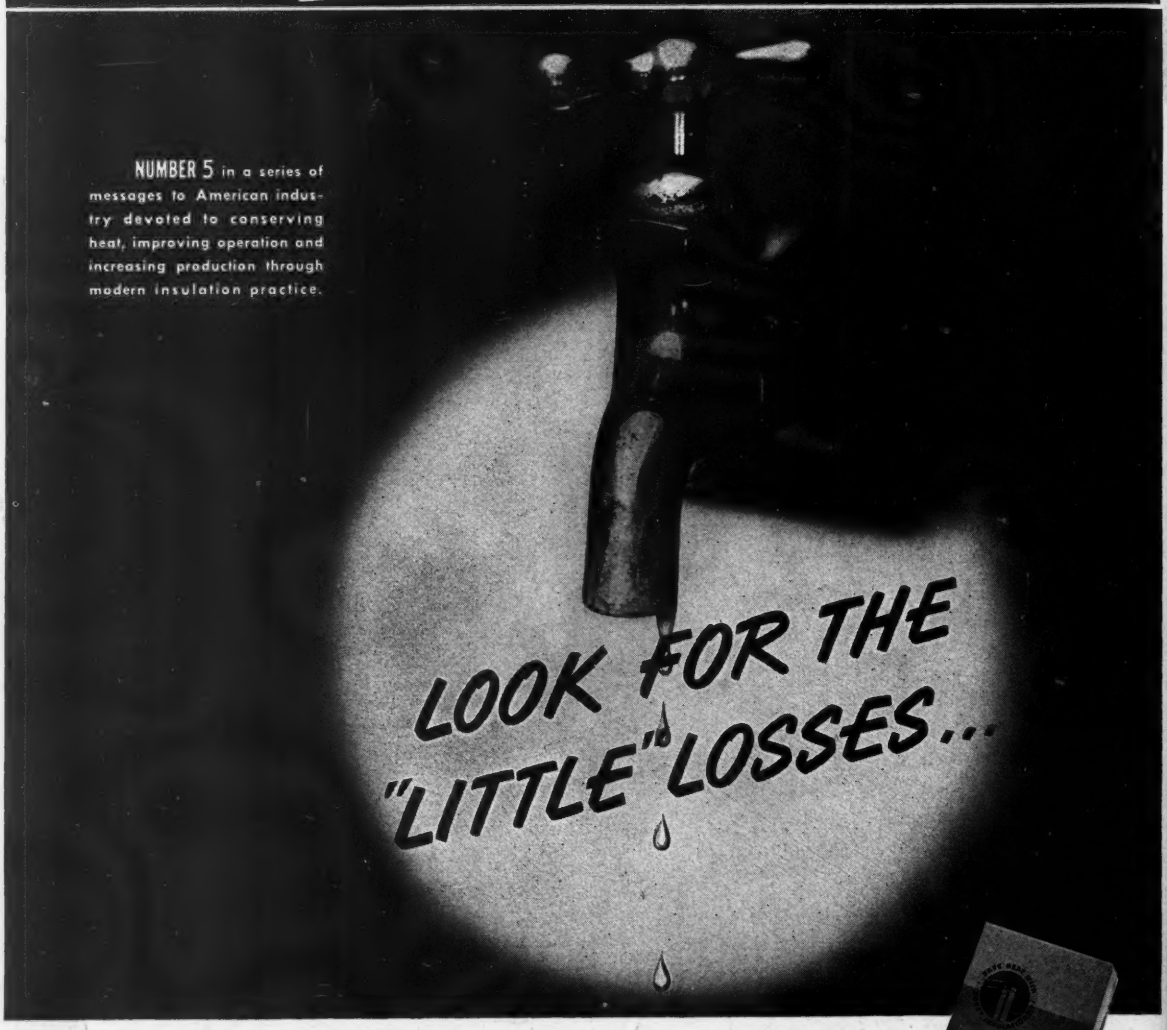
ARMSTRONG MACHINE WORKS

810 Maple Street, Three Rivers, Michigan

Builders of Steam Traps and Producers of Parts for War Equipment

GETTING THE *MOST* FROM YOUR THERMAL INSULATIONS...

NUMBER 5 in a series of messages to American industry devoted to conserving heat, improving operation and increasing production through modern insulation practice.



Like water lost from a leaking tap, the heat lost from an unprotected flange, valve or small pipe line may seem comparatively insignificant . . . but many of the few make much, and these steady small losses can quickly add to incredible totals.

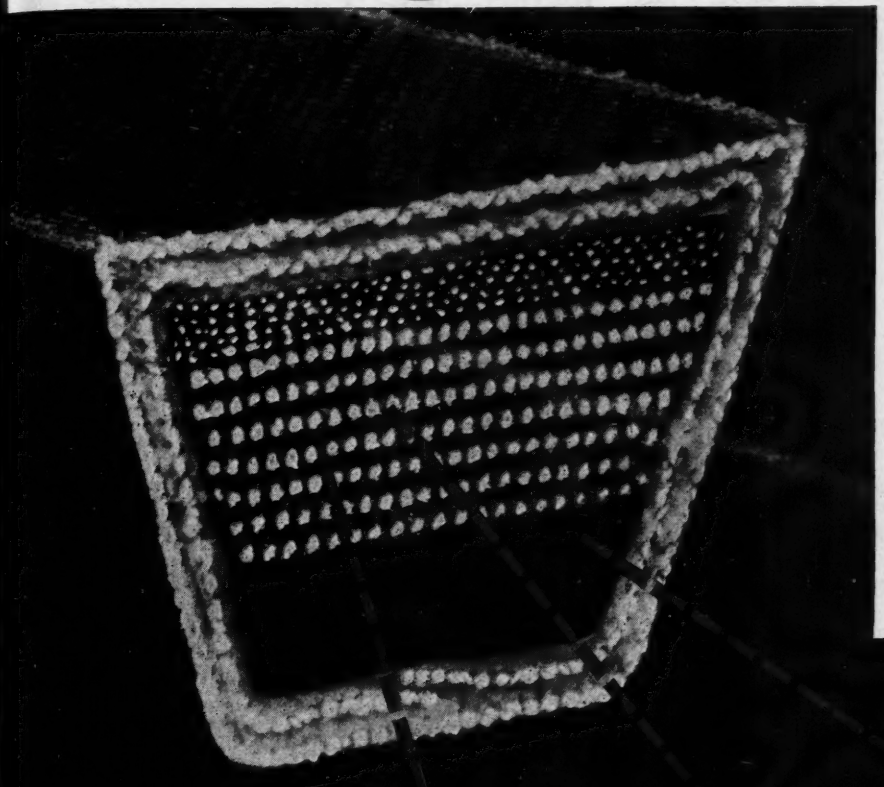
With operations under war demands proceeding at two and three times normal capacity, it is necessary that every possible pound of steam be generated, every last bit of heat conserved. The insulations on your boilers, piping and equipment should be maintained in good service condition, and all exposed lines, flanges and fittings should be adequately covered with an efficient, time-tested material . . . such as Ehret's 85% Magnesia.

★ EHRET'S 85% Magnesia and many other Ehret heat insulating materials are fully treated, both as to selection and application in the 176-page Ehret Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy of Handbook B210.

EHRET MAGNESIA MANUFACTURING CO.
VALLEY FORGE, PENNA.

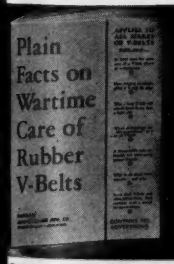
...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

X-Ray of IDEAS FOR Longer Wear



Here's the Inside of a Texrope Super-7... America's newest and most Advanced V-belt. Note the new Ways longer Life is Built right into it... for they Point to Ways *you* can Add to the Life and wartime Efficiency of your V-belts... whatever "Make" you may Use!

V-Day needs every V-Belt



FREE! Every engineer should have it in his technical library!

It's packed with vital facts on care of *all* makes of V-belts — contains no advertising. Send in for it *today!*

50% STRONGER CORDS produced by the new Flexon process combat stretching. **You** can fight stretching—and the slip and heating that result—by promptly taking up any slack in your drives. Remember, V-belts working round the clock need inspection *4 times as often* as in peacetime!

20% MORE CORDS than before help protect the new Texrope Super-7 against strains and breaks. **You** can minimize breaks in your plant—whatever "make" of V-belts you use—by requiring that V-belts *never* be pried into grooves. Good rule for cutting down internal injuries!

NEW COOLER-RUNNING CUSHION of special rubber "eases" Texrope Super-7 cords around sheaves — for smoother flexing and less heat. **You** can fight heat by preventing misalignment. It causes rubbing of belt sides. So keep sheave grooves in line — shafts parallel.

☛ *When you do Need new V-belts, invest in the Best . . . Texrope Super-7!*

A 1544

ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

TEXROPE* SUPER-7 V-BELTS

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes..... ½ h.p. to 2,000 h.p.

bearings keep cool a

as a cucumber

since this plant switched to Tycol Green Cast Greases

"We gave Tide Water the toughest lubricating job in our plant, and it is doing it to our satisfaction," declares the chief engineer of this company. "It has smoothed out for us the troublesome problem of lubricating heavy mill bearings.

"Never since we started using Tide Water Green Cast Grease have we had a single bearing overheated – even though we have been operating 24 hours a day, six days a week. Our greasing problem has been reduced to simply filling the cups once every eight hours."

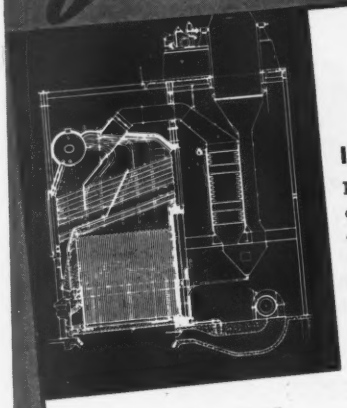
If lubricating problems hamper sustained operation in your plant, call in a Tide Water engineer. He will study your problem and recommend the proper Tide Water lubricant "engineered to fit the job." Write today for complete details to Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

TIDE WATER ASSOCIATED OIL COMPANY
EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

These TESTS tell



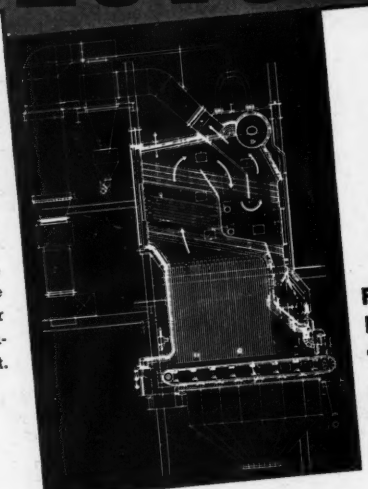
ORDNANCE PLANT INSTALLATION

Professors F. A. Berger and H. Kuenzel of Washington University, St. Louis, Missouri, acting in the interests of the War Department were supervisors of this test.

HEATING SURFACE, SQ. FT.:

Boiler	11,427
Water Walls	2,025
Economizer	3,960
Total	17,412 sq. ft.

Fuel — 11,282 B.T.U. as fired Bituminous Coal
Working pressure — 266 lbs. per sq. in.
Steam temperature — Saturation
Feedwater temperature — 224° F.
Steam load — 105,558 lbs.
CO_2 at economizer outlet — 13.9%
Gas temperature leaving economizer — 363° F.
Moisture in steam — .0178%*
Overall efficiency — 84.3%
*Moisture determination made by conductivity meter.



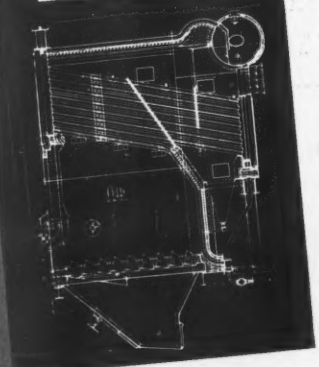
UNIVERSITY POWER PLANT INSTALLATION

This test was supervised by the University of Illinois.

HEATING SURFACE, SQ. FT.:

Boiler	6,600
Water Walls	1,870
Economizer	2,290
Air Heater	4,598
Superheater	1,424
Total	16,782 sq. ft.

Fuel — 9,518 B.T.U. as fired Low Grade Illinois Bituminous Coal
Working pressure — 325 lbs. per sq. in. ga.
Steam temperature — 650° F.
Feedwater temperature — 299° F.
Steam load — 61,686 lbs. per hour
CO_2 at air heater outlet — 13.7%
Gas temperature leaving air heater — 380° F.
Overall efficiency — 82.45%



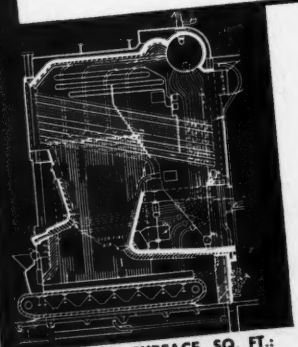
UNIVERSITY HEATING PLANT INSTALLATION

This test was conducted by the University of Wisconsin under supervision of Professor G. L. Larson, Wisconsin University.

HEATING SURFACE, SQ. FT.:

Boiler	5,000
Water Walls	160
Total	5,160 sq. ft.

Fuel — 12,510 B.T.U. Mid-Western Bituminous Coal
Working pressure — 169 lbs. per sq. in. ga.
Steam temperature — Saturation
Feedwater temperature — 164° F.
Steam load — 49,900 lbs. per hour
CO_2 at boiler outlet — 13.65%
Gas temperature leaving boiler — 424° F.
Overall efficiency — 80.06%



MODERN PAPER MILL INSTALLATION

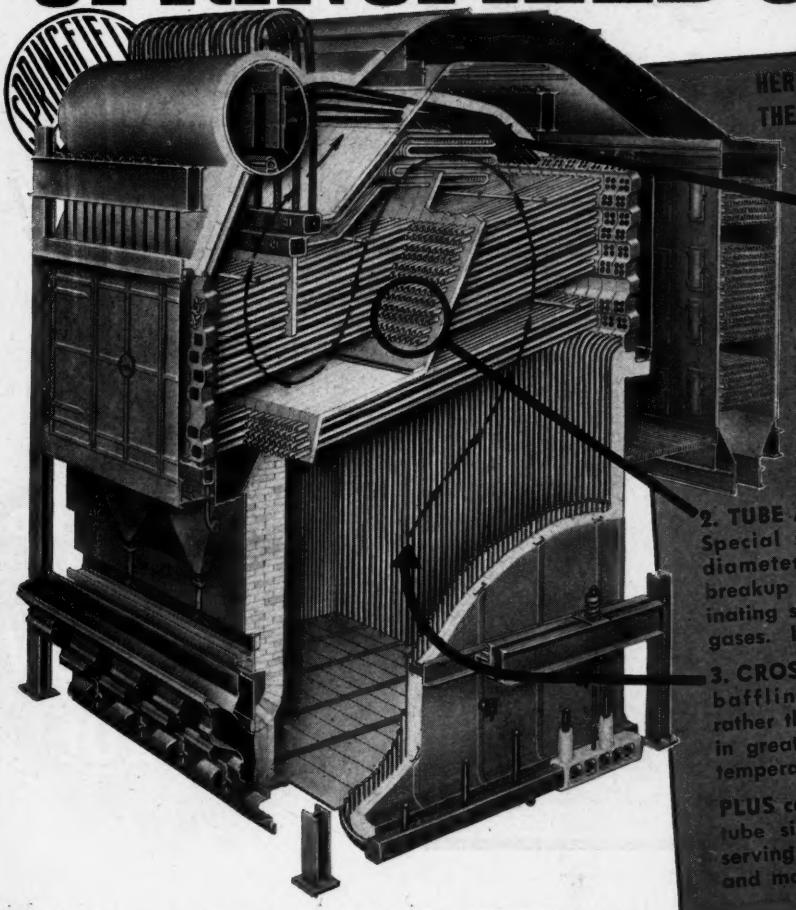
This test was performed by H. M. Wilson Company, Engineers, Philadelphia, Pennsylvania, consultants.

HEATING SURFACE, SQ. FT.:

Boiler	8,800
Water Walls	1,880
Economizer	3,000
Superheater	1,620
Total	15,300 sq. ft.

Fuel — 9,000 B.T.U. as fired Iowa Bituminous Coal
Working pressure — 241 lbs. per sq. in. ga.
Steam temperature — 517° F.
Feedwater temperature — 219° F.
Steam load — 45,625 lbs. per hour
CO_2 at economizer outlet — 12.5%
Gas temperature leaving economizer — 263° F.
Overall efficiency — 83.65%

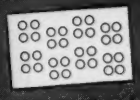
SPRINGFIELD'S *Story*



HERE ARE SOME OF THE REASONS FOR THE HIGH EFFICIENCY OF SPRINGFIELD BOILERS

1. RESTRICTED STEAM DELIVERY—All steam delivery to drum restricted and uniformly distributed across unit above normal water level. (See blacked-in section) Internal purifiers provided to fit individual requirements of each job. Because of these features, Springfield Boilers are inherently dry steamers.

2. TUBE ARRANGEMENT—Special staggering of 3" diameter tubes insures breakup of gas flow, eliminating stratification or blow through of gases. Insures maximum heat transfer.



3. CROSS FLOW OF GASES—Springfield baffling forces gas flow across tubes rather than parallel with them, resulting in greater efficiency and lower exit gas temperatures.

PLUS cast steel sinuous headers, straight tube simplicity, single drum metal-conserving design, fewer handhole openings and many other advantages.

THE performance data recorded at the left is a concise presentation of Springfield's story — conclusive proof that Springfield Boiler design features will accomplish what is claimed for them. High efficiency, dry steam, low exit gas temperatures and many other operating benefits are the direct result of Springfield's proven principles of design.

War production plants will benefit greatly by the low operating costs, high efficiency, long service life and quicker, easier maintenance of Springfield Boilers. Actual field reports show that, because they are so easily installed, Springfield Boilers can often be put into service 30 to 60 days sooner than other types of boilers.

Much time can also be saved through installation of duplicate units. Complete drawings, patterns, shop fixtures, etc., are on hand to duplicate modern Springfield units built in recent years. Pressures 75 to 750 lbs., or higher. Capacities 5,000 to 450,000 lbs. per hour, or more.

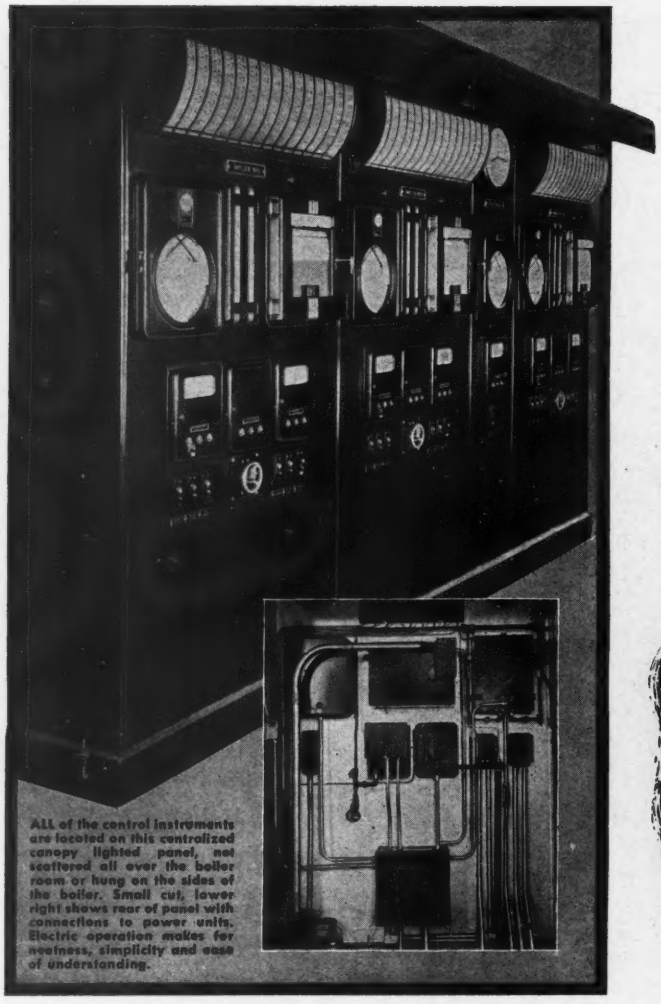
Springfield regularly takes contracts for complete steam generating units. SPRINGFIELD BOILER CO., 1951 E. Capitol Ave., Springfield, Ill.

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE



ALL of the control instruments are located on this centralized canopy lighted panel, not scattered all over the boiler room or hung on the sides of the boiler. Small cut, lower right shows rear of panel with connections to power units. Electric operation makes for neatness, simplicity and ease of understanding.

Electric
ALL THE WAY!

HAYS
CENTRALIZED AUTOMATIC COMBUSTION CONTROL

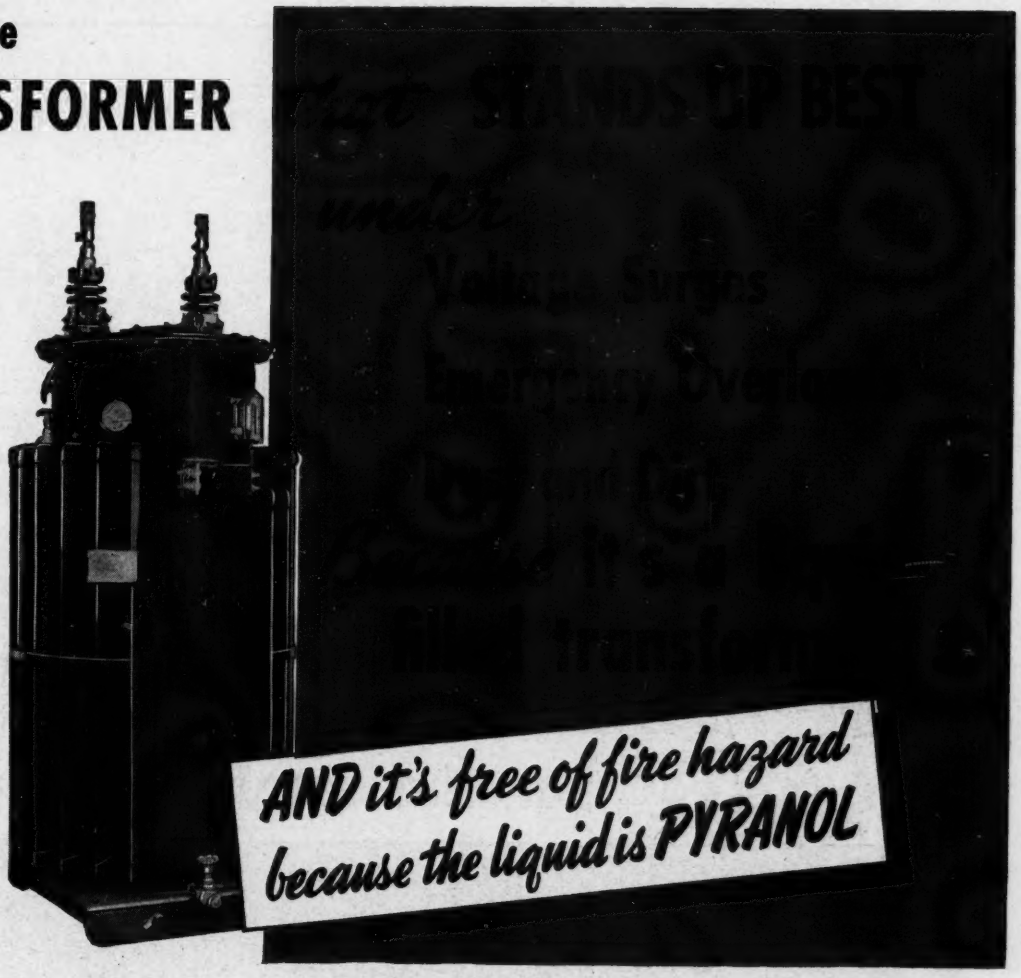
Stokers, pulverizers, fans and oil burners are more and more becoming electrically driven. It is entirely logical therefore that an automatic combustion control system be operated electrically. Hays *centralized* control is operated entirely by electricity, employing enclosed mercury switches for the sensitive contacts, thus assuring freedom from trouble due to moisture, dust, dirt and chattering. Electric operation also simplifies installation and maintenance. Adjustments are made direct and are not dependent upon air pressures, oil pressures, and the numerous valve mechanisms made necessary by non-electric designs. When considering automatic combustion control buy for tomorrow—buy electric—buy **HAYS.**

HAYS *Automatic* COMBUSTION CONTROL

THE MODERN SYSTEM—*it's Electric!*

THE HAYS CORPORATION • • • MICHIGAN CITY, INDIANA

Here's the TRANSFORMER



333-kva Pyranol* transformer, rated 60 cycles, 2400/4160 Y volts to 240/480 volts

PYRANOL transformers have all the features that have made liquid-cooled transformers the most nearly trouble-free electric apparatus in service today. For example:

They have high dielectric strength both at normal frequencies and impulse—an important safeguard against damage to the transformers from voltage surges caused by switching operations or by lightning. Immersion of the transformer interior in the Pyranol prevents drying and cracking of the winding insulation, a feature vital to maintenance of the high dielectric strength originally built into the transformer.

The heat-storage capacity inherent in liquid-filled transformers makes Pyranol units ideal for emergency overloads.

The pressure-tight tank protects vital parts of the transformers against damage from moisture, dust, dirt, and sabotage.

Additional Benefits

1. Saving in Copper. Secondary conductors (480 volts) require about 15 times as much copper as equivalent lengths of 4160-volt primary conductors. In a typical, large industrial plant, installation of Pyranol transformers indoors at load centers can save 50 per cent or more on copper—30,000 pounds or more.

2. Saving in Installation Cost. Because Pyranol made possible a vaultless installation of several small transformers indoors (instead of one large transformer outdoors), it brought over-all savings of approximately 20 per cent in the installed cost of a plant distribution system.

3. Saving in Power. Pyranol transformers at load centers reduce copper losses as much as 25 per cent.

Ask your G-E representative for complete information, or write for Bulletin GEA-2048D. *General Electric, Schenectady, N. Y.*

**Pyranol is the G-E trade name for askarel. Pyranol is noninflammable, and no Pyranol transformer has ever burned or contributed to a fire.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

GENERAL ELECTRIC

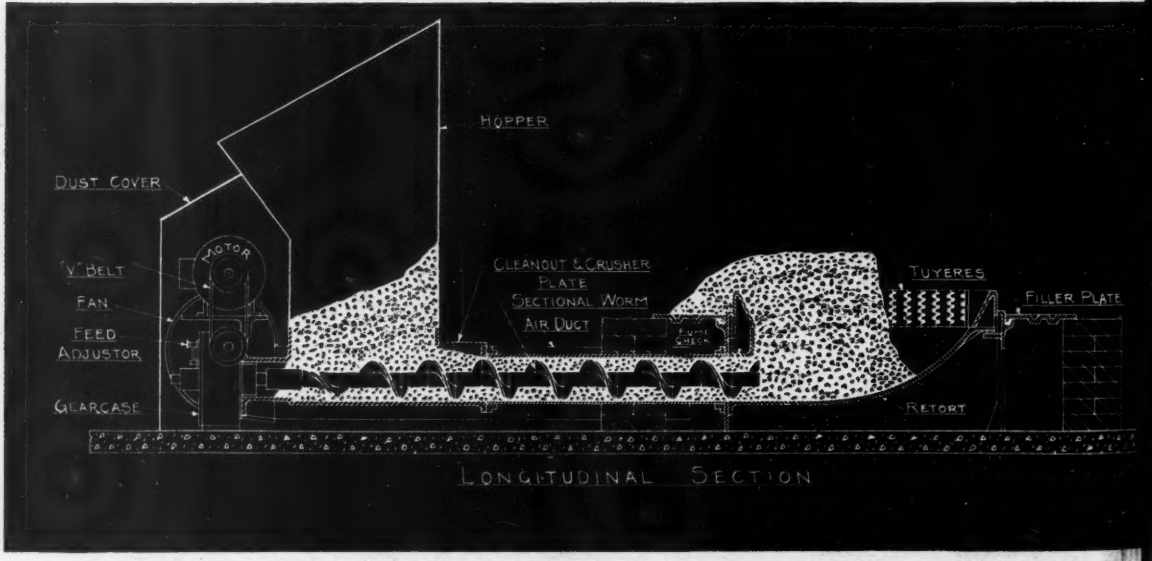
402-55-5100

also...

CANTON STOKER

EXTRA HEAVY WORM FEED CANTON STOKERS

. . . for the smaller boilers



Cutaway view showing assembly of DeLuxe Stoker and method of feeding coal. This gives you a complete picture of the stoker's action, along with good views of the various components that go to make up the entire stoker.

CANTON STOKER CORP.

Mfgrs. of Vulcan Ramfeed Stokers . . . up to 850 H.P.
Lo-Set Ramfeed Stokers . . . up to 450 H.P.

Mfgrs. of Deluxe Wormfeed Stokers . . up to 175 H.P.
Standard Wormfeed Stokers . up to 125 H.P.

. . . convert now from

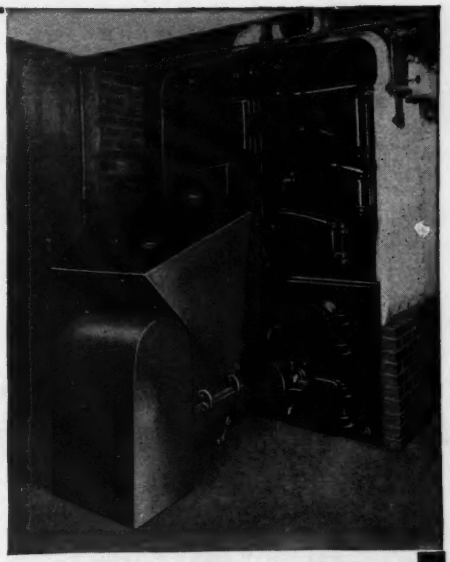
OIL to COAL!

anton Standard and DeLuxe Side Dump WORM FEED Stokers are, generally eaking, smaller editions of the recognized, approved CANTON VULCAN d LO-SET RAMFEED Stokers, widely used on High Pressure Power and ocess Boilers. Like their larger counterparts, they're carefully engineered nd built with precision, so as to get the best performance from each type f boiler.

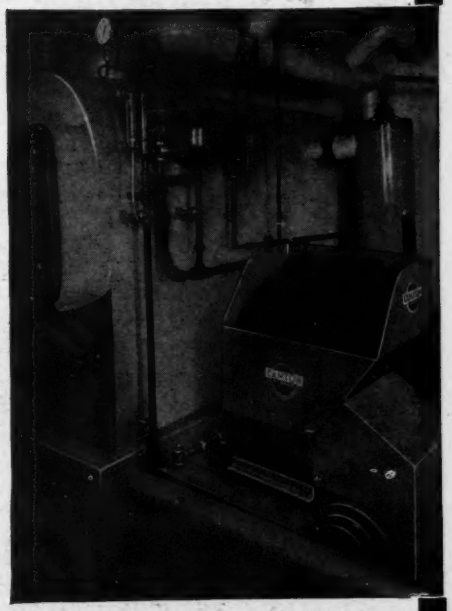
imple and sturdy in design, these smaller units operate at low cost . . . . e seldom "off the line" for servicing . . . reduce fuel costs by producing ore heat from the fuel . . . . burn cheaper grades and sizes of coal . . . . iminate soot in boiler flues.

Vith these Canton Stokers in service on your boilers, you can go a long ay toward achieving labor conservation, more constant steam pressures, epped-up production, reduced spoilage and compliance with local smoke rdinances.

urely, an investment in these Stokers will quickly liquidate itself in savings nd service. Want complete details? . . . . fill in and mail the attached oupon, or, write, wire or phone our nearest office or our factory and ask for Free Consultation on Combustion Problems . . . . our staff of Field Engineers at your Service.



DeLuxe Side Dump Stoker adapted to a Cast Iron Sectional Boiler. The Full Front adds trimness to the job, as well as providing accessibility and cleaner operations.



Clinker Plate installation made from side of Boiler. Where space in front of Boilers is limited, a side installation often provides a practical solution.

WRITE FOR THIS CATALOG

Here you'll find all the pertinent data that will enable you to intelligently plan for and use CANTON STANDARD and DELUXE Stokers.

00 ANDREW PLACE, S.W.

ANTON • OHIO

CANTON STOKER CORPORATION
900 Andrew Place, S.W., Canton, Ohio

Gentlemen:
Please send me at once your new catalog covering the Standard and DeLuxe Extra Heavy Worm Feed Stokers.

Name .....

Company .....

Address .....

City ..... State .....

A SINGLE OBJECTIVE.....

Production Control

A SINGLE RESPONSIBILITY IN ACHIEVING IT

Maximum production and uniform quality of product result from efficient control of steam generating and industrial process equipment. An invaluable aid in achieving this is a system of automatic controls and instruments that allows operators to concentrate on the factors making for optimum production. To secure these results, Republic Flow Meters Co. offers a complete manufacturing and engineering service—a single responsibility—in the field of measurement and control. We will gladly co-operate with you in the solution of any metering or control problem you may have. Your inquiries involve no obligation on your part.

ELECTRICAL FLOW METERS
For steam, water, gas, air, oil, etc.

MECHANICAL FLOW METERS
For steam, water, gas, air, oil, etc.

INDICATORS AND RECORDERS
For draft, pressure, flow, level, temperature, CO_2, etc.; single and multiple types

CO_2 METERS
For measuring combustion efficiency

THERMOMETERS
For temperatures up to 1000 F

BOILER CONTROLS
For all boilers, all types of firing

REGULATORS
For pressure, flow, speed, level, ratio

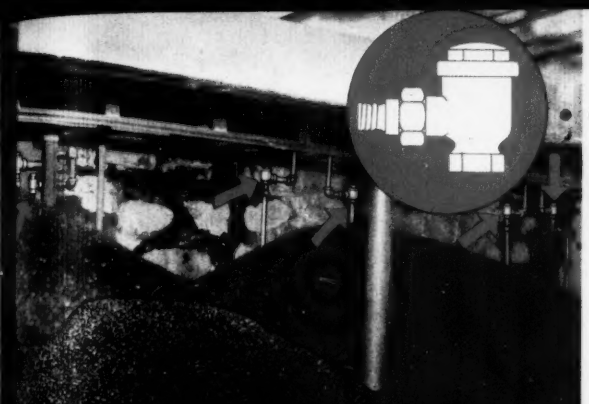
PNEUMATIC TRANSMITTERS
For measuring and controlling flow, level, pressure, etc.

REDUCING VALVES
For tough jobs in control of steam and water

DESUPERHEATERS
For control of steam temperature

DATA BOOKS MAILED ON REQUEST

REPUBLIC FLOW METERS CO.
2224 Diversey Parkway, Chicago, Illinois



Sarco Thermostatic Steam traps guarding the coal pile in a large industrial plant.

. . . THE ANSWER TO

"What can I do?"

Do you feel "stuck with it" for the duration? Like to shoulder a gun? So would most of us — but you can probably do more to help win the war right where you are.

Suppose every reader of this publication were to reduce fuel and water consumption only 10%. Suppose this reduced slow ups, shut downs, and rejects, and speeded up production only 10%. The result would be a tremendous contribution to victory in this war of production. That's your job and Sarco's job for the duration.

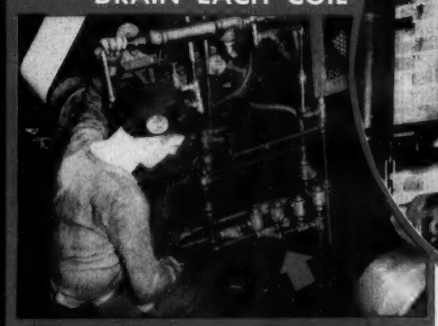
A few suggestions are given on this page. A hundred more are shown in the new Sarco Hook–Up Book with calculation tables and recommendations.

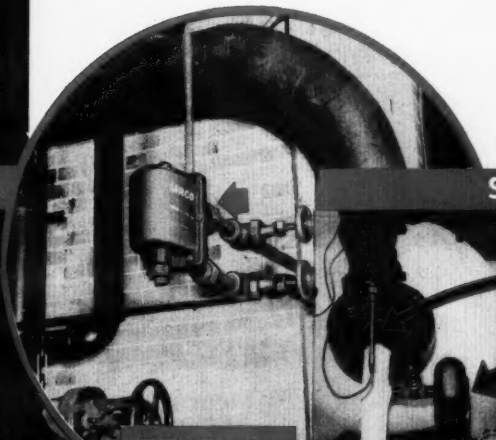
Begin the speed-up and savings now. Our nearest representative is ready to help you.

FUEL
Is one-third of the nation's transportation tonnage

A carload of Sarco steam traps can save as much as 100 carloads of fuel a year

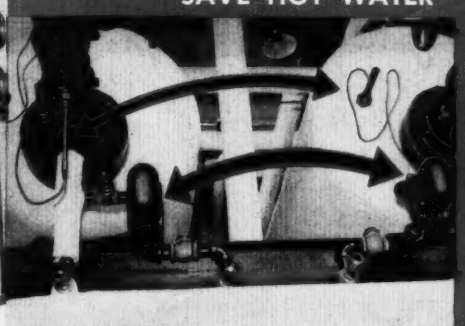
DRAIN EACH COIL

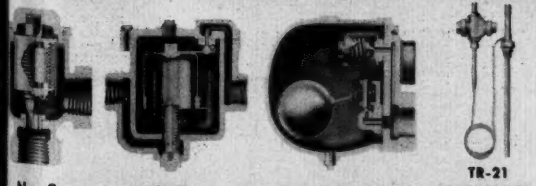




DRAIN THE LINES

SAVE HOT WATER





No. 9 BUCKET — FLOAT-THERMOSTATIC — TR-21 REGULATOR

SARCO Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK

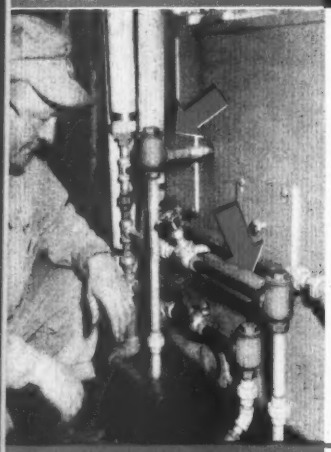
Represented in Principal Cities

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONT.

Solving new Problems

WITH SARCO

PAPER MILK BOTTLES

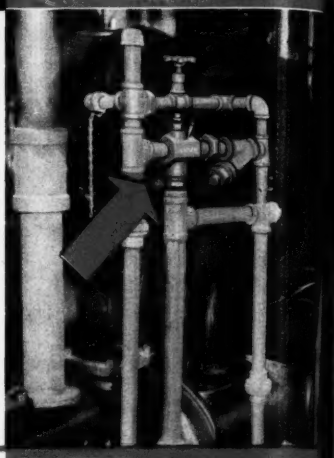


SARCO No. 9

Milk delivered in paper containers is now preheated, pasteurized, cooled, bottled in stream-lined machines which take the place of entire old line dairies.

Excello Aircraft's "Pure-Pak" machines, a leader in this field, come equipped with Sarco No. 9 thermostatic steam traps. No. 9 is the ideal condensate drainer for process equipment. Small, easy to install, requires no seat change when pressures change. Retains more heat in the machine than any other type of trap. Catalog 250.

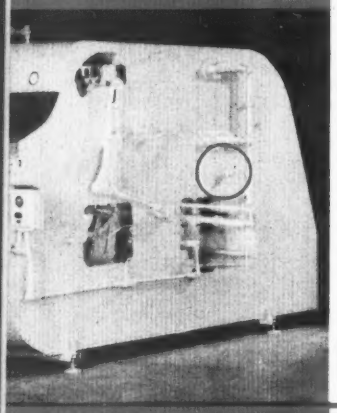
COMPRESSORS



SARCO TYPE TR-40

Compressors — Up to 50% of the cooling water used on air compressor jackets is being saved by the use of this simple temperature control, easy to install. It also saves on lubricating oil while protecting the compressor against overheating. Used also on Diesel engines, stills, condensers, water cooled dies, etc. Catalog No. 700.

FOOD



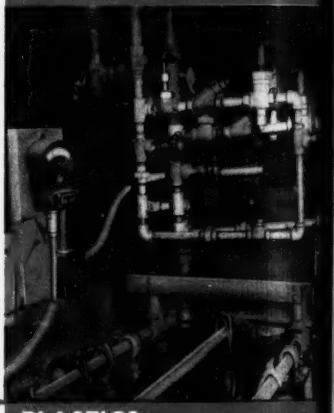
SARCO No. 87S

This leading equipment manufacturer streamlined temperature control on a new low-cost bottle washer by selecting two simple Sarco regulators.

Type 87S heats the rinse water by direct steam injection, maintaining constant temperature at little more than the cost of a silent injector nozzle alone. Catalog 550.

Wash water temperature is held within a degree or two by a low cost Sarco type TR-50 rigid stem, self-contained regulator. Catalog 600.

PLATING



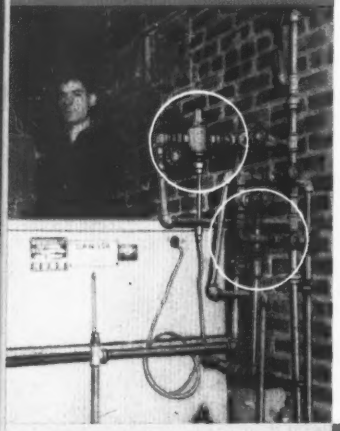
SARCO LSI

Sarco has developed a simple electric control for both heating and cooling of chromium plating solutions.

A single electric thermostat controls two magnetic valves and the maintained temperature is indicated continuously on a thermometer built into the thermostat.

Control is maintained within plus-minus 1°F. at a fraction of the cost of conventional air operated equipment. Catalog No. 1025.

DEGREASING

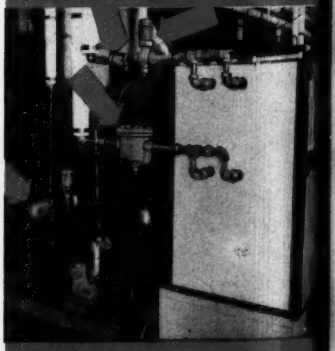


SARCO TYPE VL

Degreasing — Modern metal parts cleaning machines using trichlorethylene vapor, require accurate temperature control of both heating and cooling. Leading manufacturers of degreasers secure the desired result by furnishing as standard equipment simple Sarco self-operated regulators, type VL for heating coils, type TR-40 for the cooling water.

Together these hold a constant vapor line and at the same time save steam and water. Catalog Nos. 600 and 700.

PLASTICS



SARCO OVEN CONTROL

Transcription records for radio programs require accurate temperature control of the steam heated drying ovens.

Sarco solved the problem for this leading manufacturer, with Sarco inverted bucket steam traps on the supply, float-thermostatic traps draining the coils, and the simple type LSS electric valve control. Customer reports: "Works like a charm; temperatures are always the same!"

Catalogs Nos. 350, 450 and 1000.

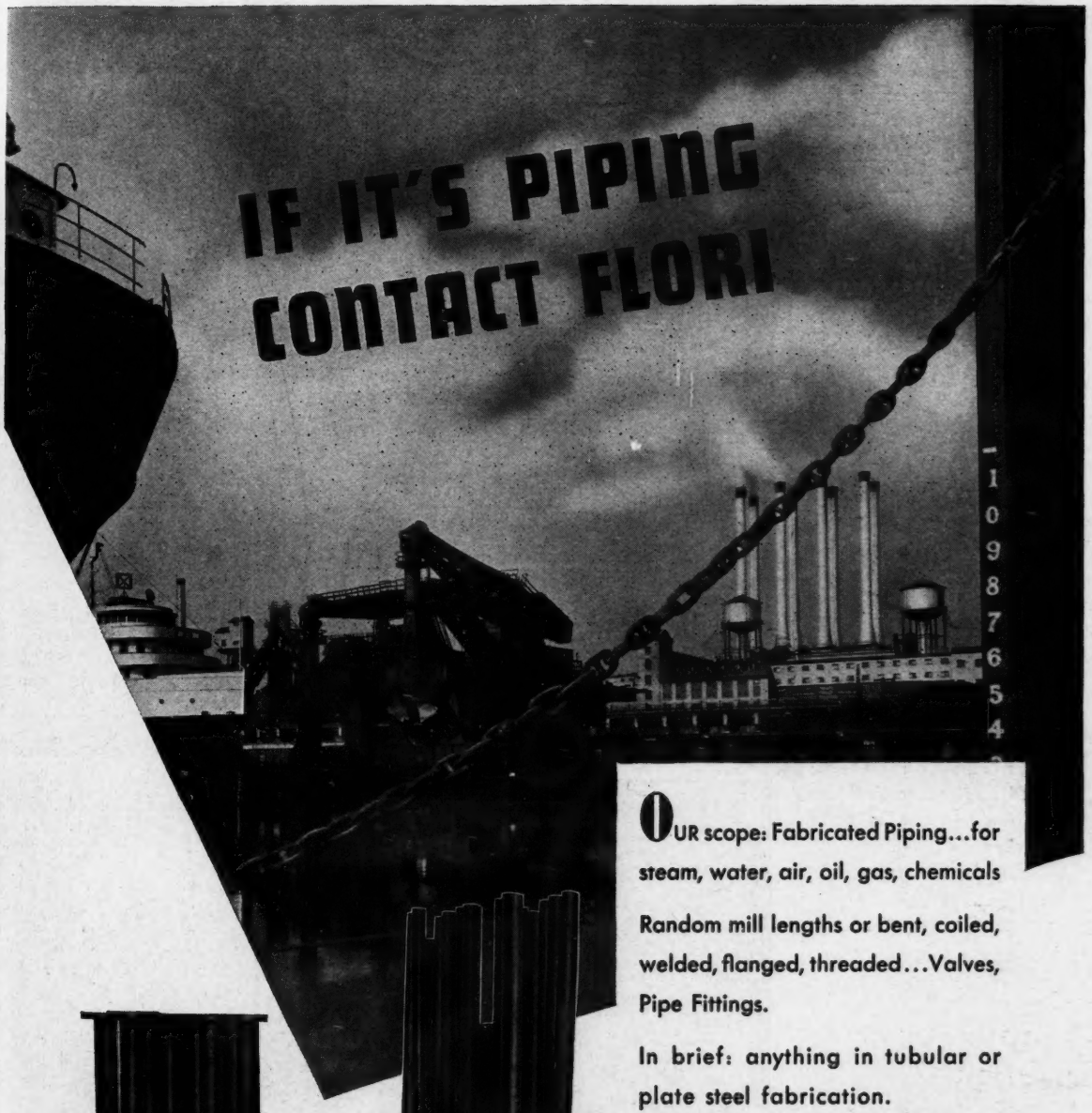
SARCO

Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVE., NEW YORK

Represented in Principal Cities

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

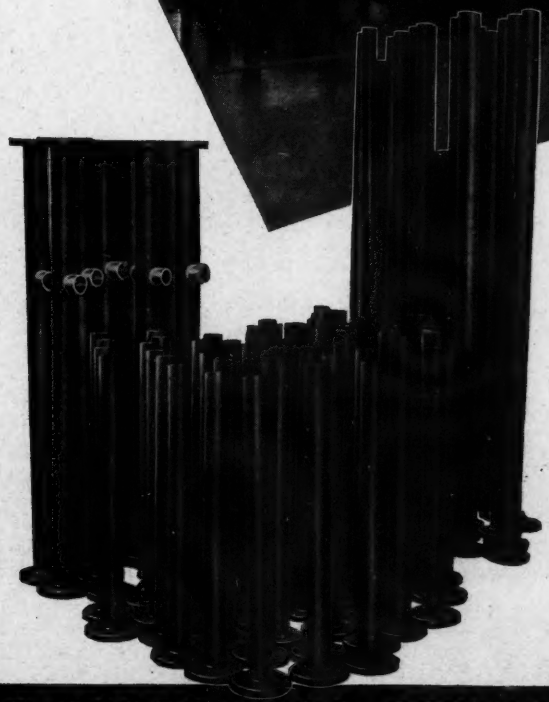


OUR scope: Fabricated Piping...for steam, water, air, oil, gas, chemicals

Random mill lengths or bent, coiled, welded, flanged, threaded...Valves, Pipe Fittings.

In brief: anything in tubular or plate steel fabrication.

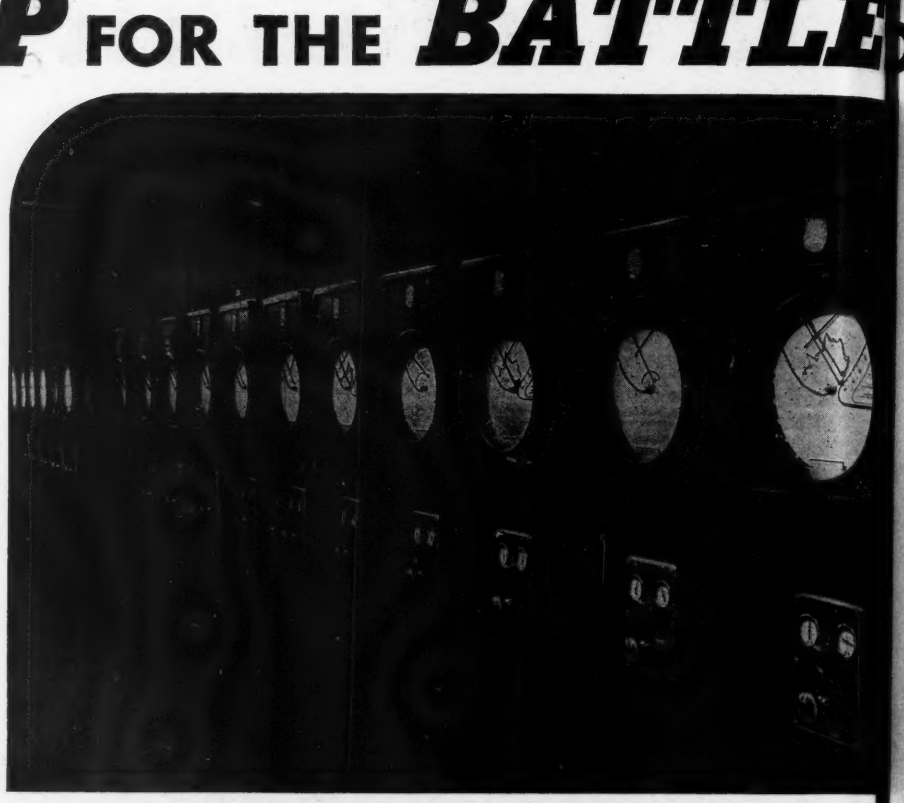
Our present customers: United States of America and Allied Nations. Our postwar customers: You!...we hope.



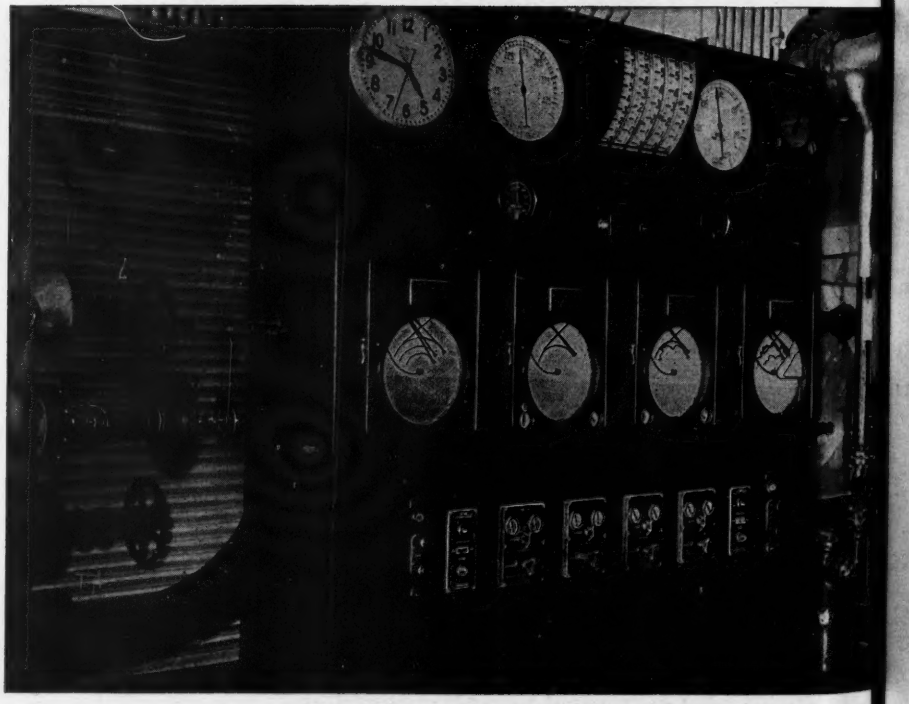
FLORI PIPING

THE FLORI PIPE COMPANY • ST. LOUIS, MO.

HELP FOR THE BATTLE OF



These Bailey Meters and Controls insure maximum steaming capacity, minimum "time out" for repairs; and most economical use of fuel in a steel mill and a chemical plant.



BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT CONTROL

OF 168 HR. PRODUCTION

Production for victory under the 168-hour week will try the soul of many a power plant engineer.

Steaming capacity will have to be stretched to the limit. Shutdowns for maintenance will result in lost production. Certain fuels will not be available and all fuels will have to be used with economy. Trained men will become scarce.

Under these conditions we will have to make the most of what we have. To help power engineers win the battle of 168-hour steam production, Bailey Meter Company has published a bulletin, "How to Safely Stretch Steaming Capacity".

This bulletin makes numerous fundamental suggestions which can be carried out without the use of elaborate metering or control equipment. It also explains how the proper use of metering and control equipment:

1. Stretches steaming capacity.
2. Avoids frequent shutdowns for maintenance.
3. Insures safety of men and equipment.
4. Furnishes data for comparison of fuels.
5. Reduces consumption of fuel.
6. Maintains efficiency while training new operators.

These suggestions will help you win the battle of 168-hour production. Ask for Bulletin No. 16. It will be sent without obligation of any kind.

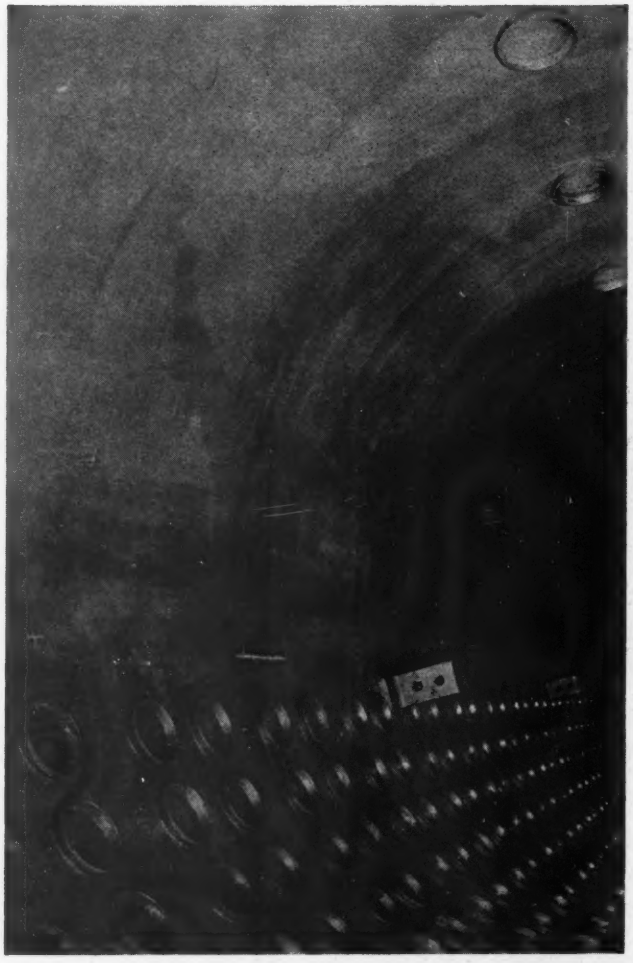
BAILEY METER COMPANY
1040 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

BAILEY METERS

...he Complete Combustion Control System

...TROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

Back into Service For Years to Come



APEXIOR Protection Insures New Boilers — Gives Old Boilers New Life

You'd scarcely throw a house away because the roof was worn. Boilers, too, can be kept in service by resurfacing irreplaceable boiler metal with a protective APEXIOR coating.

On boiler metal, even so old and worn that it is ready to be junked, APEXIOR has repeatedly kept equipment in service indefinitely. Just clean down to bare metal. Then if the required hydrostatic test can be passed, simply "painting" it with APEXIOR NUMBER 1 will keep that equipment on the line.

APEXIOR — A Long-Lasting, Replaceable Extra Surface

Easily applied with a hand-brush or power-coater, APEXIOR NUMBER 1 adds an impenetrable, durable barrier on boiler tubes and drums, stopping corrosion and resisting wear. It is a chemically inert, mechanical coating which seals up the pores and joints, prevents corrosion from penetrating, taking the wear instead of the metal.

Any scale that may form is loosely adherent, unable to bond chemically with tube and drum walls, and can be removed by wire brushing.

And it *lasts* — two, three years, or more. Then, one-coat resurfacing is all that is needed.

APEXIOR Guarantees Good Metal Condition— No Other Protection Offers the Same Assurance and Security

APEXIOR NUMBER 1 supplements feedwater treatment, giving *extra* protection and that peace of mind that comes from knowing that *everything* has been done to insure maximum life and good housekeeping to steam boiler equipment.

For years, power engineers with a desire for peak efficiency have found it valuable. Now, *every* plant must have this assurance in coaxing top production, long life and availability from irreplaceable equipment.

Recommended by all U.S. & Canadian boiler insurance companies

Write for Bulletin 1290

APEXIOR
REG U.S. PAT. OFF.

THE DAMPNEY COMPANY OF AMERICA

PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

HYDE PARK · BOSTON · MASSACHUSETTS

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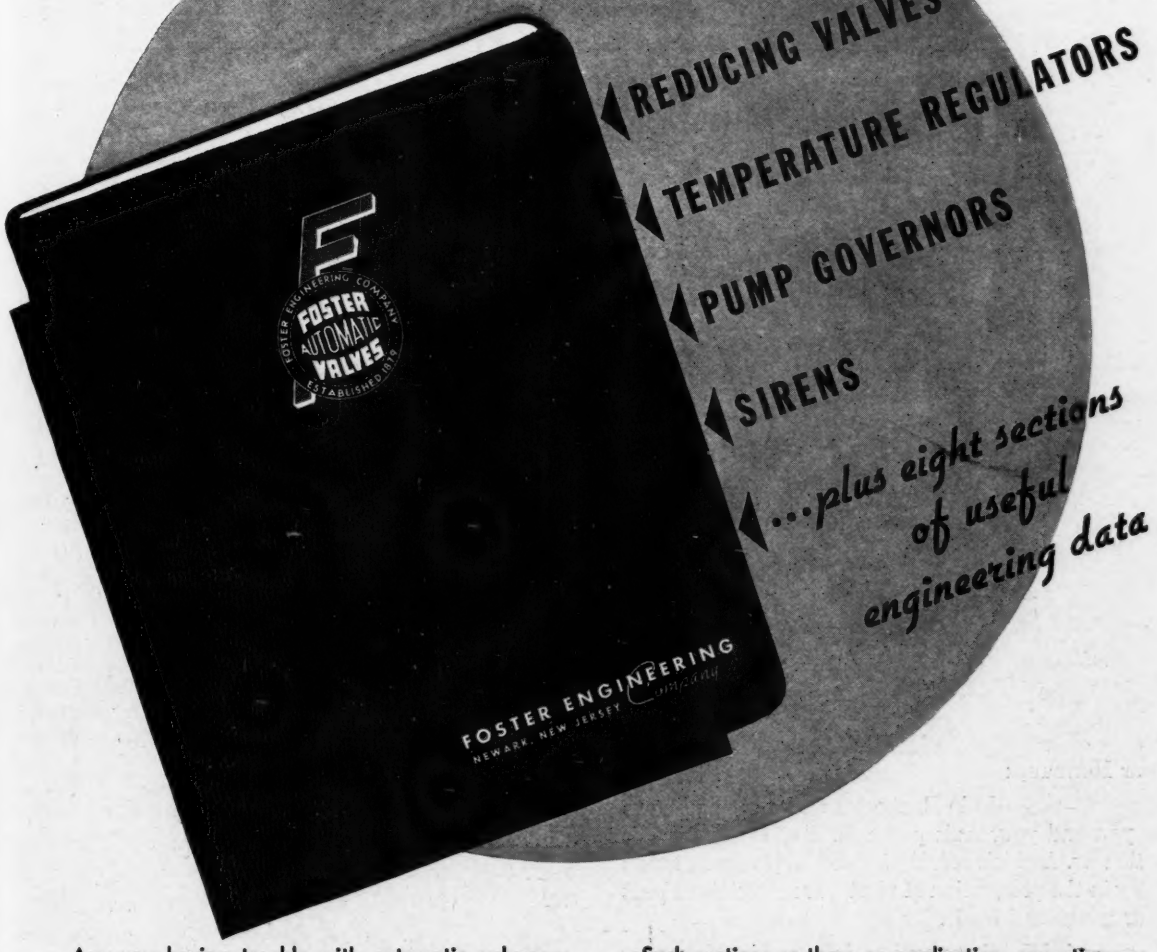
Here is Your handbook on



Are you having trouble with automatic valves — ragged regulation, constant cleaning, repeated repairs and replacements?

Have you a regulation or control problem that hasn't been licked — a service that has been "just too much" for the average automatic valve?

There may be a practical and profitable solution to your problem in this new catalog covering one of the most complete lines of automatic valves, for its content is not limited to a mere "sales story".

Such sections as those on application, operation, installation, and inspection, as well as the inclusion of eight complete sections of engineering data, make this catalog virtually a handbook of useful information.

A copy of this catalog will be sent to executives and engineers in those industries that are "all out" for victory if the request is written on their company's letterhead. Simply ask for Catalog 70.

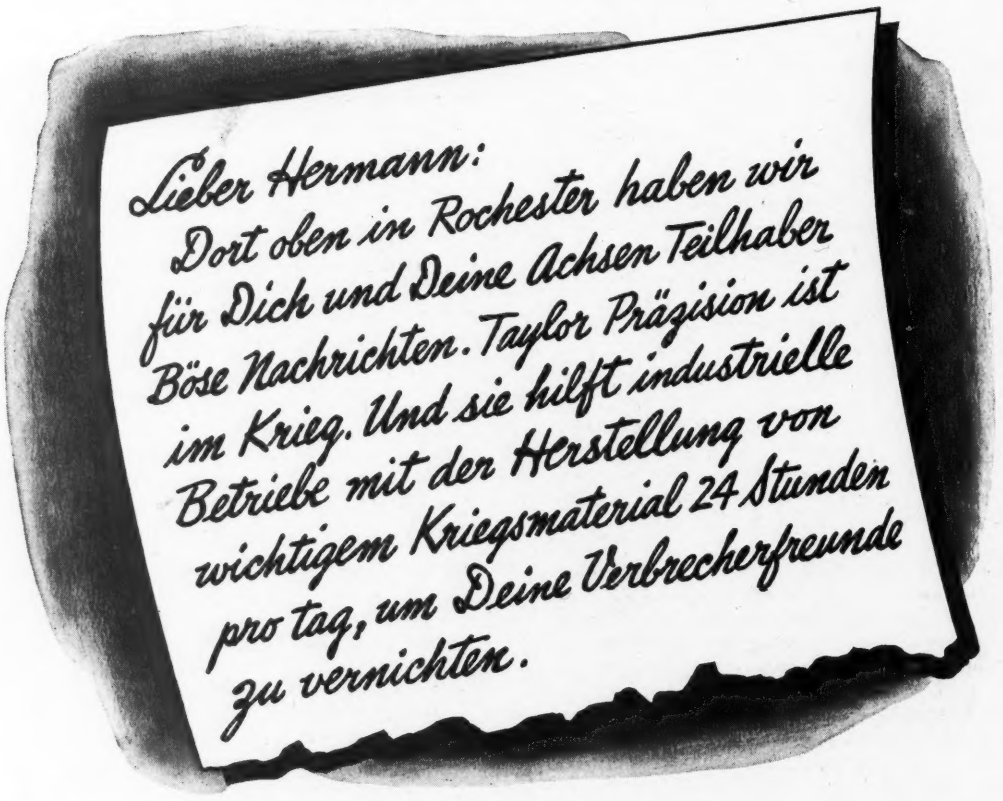
FOSTER ENGINEERING *Company*

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

111 MONROE STREET • NEWARK, N. J.

An open letter TO A NAZI SPY

(who may be planning a certain visit)


Lieber Hermann:
Dort oben in Rochester haben wir
für Dich und Deine Achsen Teilhaber
Böse Nachrichten. Taylor Präzision ist
im Krieg. Und sie hilft industrielle
Betriebe mit der Herstellung von
wichtigem Kriegsmaterial 24 Stunden
pro tag, um Deine Verbrecherfreunde
zu vernichten.

Dear Hermann:

Up in Rochester we've got bad news for you and your Axis partners. *Taylor Accuracy is in the war.* And it's serving industrial plants 24 hours a day in the production of vital war materials to beat your gangster friends.

There isn't anything you can do about it, Hermann. Don't try to find out about Taylor Accuracy unless you want 1600 liberty-loving Americans to run you out of town. They're rough on rats like you.

Why is our slogan, "Taylor Means Accuracy First" bad business for the Axis? Because in the minds of Taylor men there is only one thought—to build the most accurate instruments possible for measuring and controlling temperature, pressure, humidity, rate of flow and liquid level. Instruments so accurate that U. S. war plants will be able to produce guns, tanks, ships, airplanes, gasoline, ammunition, clothes, food and raw materials better and faster than you can. Every Taylor employee is a craftsman who stakes his reputation on the accuracy of the instrument he makes. Every Taylor Field Engineer is honor bound to see that every instrument you buy does its work 100%. That's been true for nearly a hundred years.

This isn't the first time Taylor Accuracy has gone to war. It is helping to win *this* war, and make a better world afterward for every man, woman, and child.

Taylor Instrument Companies
Rochester, N. Y. and Toronto, Canada

Taylor Instruments
MEAN
ACCURACY FIRST
Indicating, Recording, Controlling
TEMPERATURE, PRESSURE, HUMIDITY, FLOW AND LIQUID LEVEL

TO AMERICANS ON THE HOME FRONT: *Taylor Household Thermometers and Weather Instruments have enlisted for the duration. Most stores still have stocks on hand. If yours hasn't, remember—Taylor's war experience will bring you even better instruments later!*

★ ★ ★ KEEP ON BUYING U. S. WAR SAVINGS BONDS AND STAMPS ★ ★ ★

CORRECT SHOP PRACTICES
now more important than ever . . .

These working instructions can help save time, speed war production, and conserve vitally needed materials

T-2—Welding, Brazing and Soft Soldering of Monel, Nickel and Inconel . . . Detailed instructions on all joining processes applicable to Monel, Nickel, Inconel, Monel-clad steel, Nickel-clad steel, Inconel-clad steel, "K" Monel and "Z" Nickel . . . Instructions on jigs and clamps, welding wires and fluxes, overlaying, hard surfacing, welded linings, cleaning, heat treatment, grinding and finishing.

T-4—Methods for the Fabrication of Clad-steel Plate . . . How to make heavy, corrosion-resistant equipment from Nickel-, Monel-, and Inconel-clad steel plate. Includes instructions for working where methods differ from regular steel plate practice.

T-11—Forging Monel, Nickel and Inconel . . . Discusses the ready forgeability of these materials into almost any shape that can be forged in steel. Data on proper methods of heating dies, lubrication, mechanical properties of forgings.

T-12—Machining Monel, Nickel and Inconel . . . General recommendations on cutting feeds, speeds, depth of cut; tool design, cutting, tool steel and cutting compounds.

T-14—The Design and Construction of Heavy Equipment in Monel, Nickel and Inconel . . . Discusses problems commonly encountered and outlines proper procedure for fabricating heavy equipment from Monel, Nickel and Inconel.

T-16—The Heat Treatment of "K" Monel and "Z" Nickel . . . Indicates the mechanical properties obtained from various forms and tempers. Explains the cycles of heat treatment and the heat treating conditions necessary to obtain satisfactory results.

T-17—Fabrication of Monel, Nickel and Inconel Seamless Pipe and Tubing . . . Instructions on machining, welding, cutting-off, thread cutting, bending and coiling. Includes data on mechanical properties, bursting and collapsing strengths of full cold-worked seamless tube.

T-19—The Deep Drawing, Shearing and Perforating of Monel, Nickel and Inconel . . . Directions for shearing, perforating, blanking, cupping, drawing and other press-forming operations; die materials, lubricants, annealing, pickling and mechanical properties.

T-20—Annealing Nickel, Monel and Inconel . . . Detailed instructions for soft annealing, temper annealing and stress-equalizing annealing by open and closed methods; bright annealing, fuels, furnaces, atmospheres, temperature control, effect of cold work, grain size and mechanical properties.

T-21—Pickling Monel, Nickel and Inconel . . . Describes methods for removing oxide and tarnish from annealed shapes, etc. Includes recommended formulae for pickling solutions and pastes.

TS-5—Grinding, Polishing, Buffing Monel, Nickel and Inconel . . . How to produce any desired finish on Monel, Nickel and Inconel; proper wheels and abrasives to use, preparing glue and wheels, speeds, procedures for grinding, polishing, buffing and brushing. Includes working chart.

Spinning Monel and Nickel . . . Describes the general procedure for spinning Monel and Nickel; information on lubricants, tools, chucks, speeds, annealing, pickling, etc.

List "B" . . . A complete listing of INCO technical Bulletins.

☆ ☆ ☆

Check bulletins desired, mail coupon or your request by letter to The International Nickel Company, Inc.

INCO NICKEL ALLOYS

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

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☐ T-17 ☐ T-19 ☐ T-20 ☐ T-21 ☐ TS-5 ☐ List "B"
☐ Spinning Monel and Nickel

*Name*_____ *Company*_____

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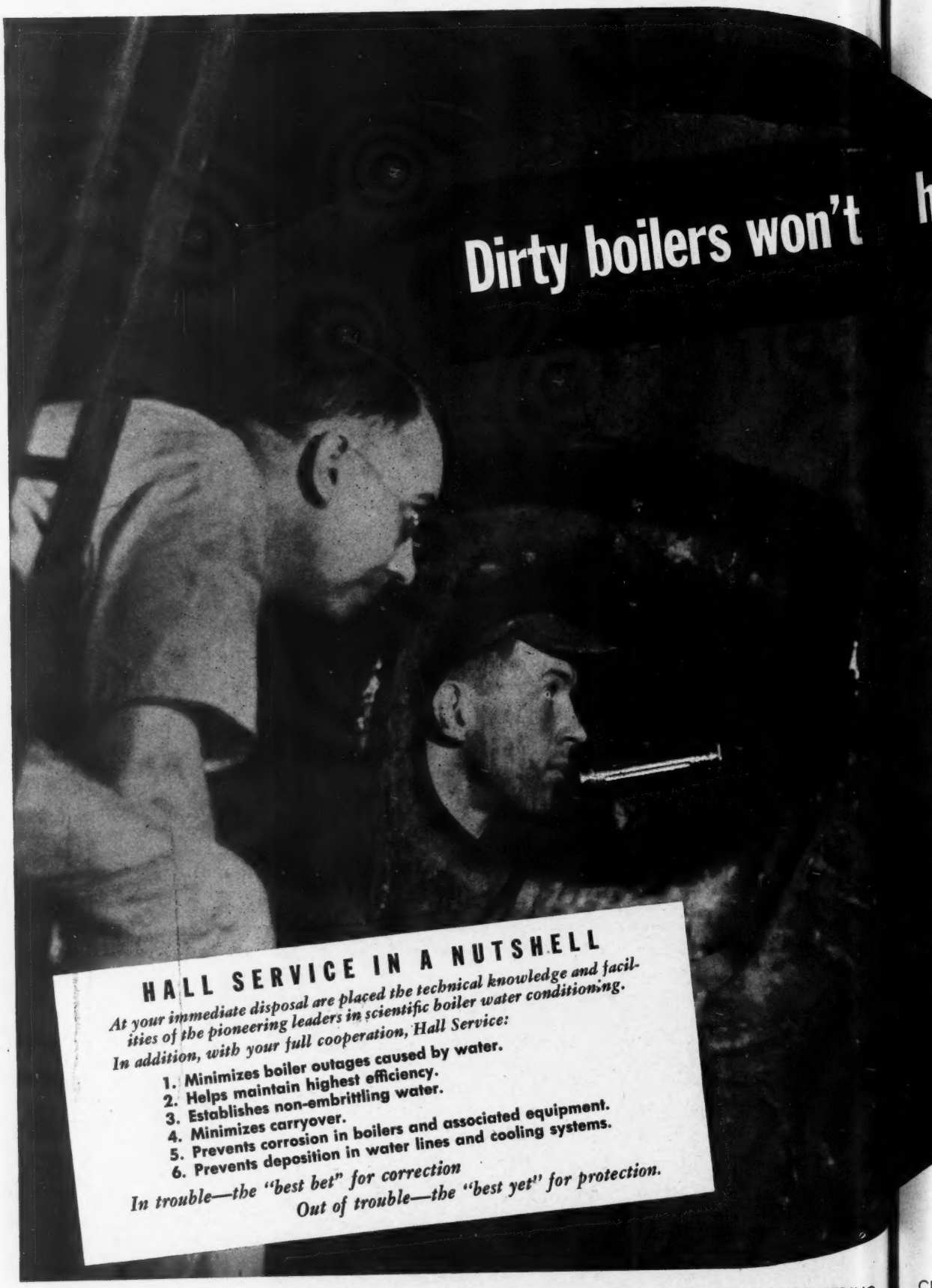
*Title*_____ *Address*_____


Dirty boilers won't
HALL SERVICE IN A NUTSHELL
At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning.
In addition, with your full cooperation, Hall Service:
1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.
In trouble—the "best bet" for correction
Out of trouble—the "best yet" for protection.

help you break production records!

America's war effort provides enough problems without your having to fight for steam, too

You can't win a battle on the production line while fighting a second front in your power plant.

Dirty boilers suffering from the ills of scale, corrosion, carry-over and embrittlement do more than cause untold harm to your own operations. They seriously impede the flow of critical materials. And they waste supply parts which are rapidly becoming irreplaceable.

How often do you have a boiler down for cleaning and repairs? What preventive measures are you taking? Maybe you've just been lucky. But how long do you think your luck can last?

Dirty boilers, tube failures and other boiler ills don't "just happen" and don't have to happen. There is always a cause, however obscure. These causes can usually be determined long before they become serious.

That is what Hall Service is doing for industrial steam plants — giving them "preventive care," locating trouble causes, pointing the way to their cure. Hundreds of America's war industries are profiting from it today. They've almost forgotten what an unscheduled outage means.

Thoroughness, backed by sound chemical and engineering experience, is the reason why Hall Service could mean so much to your steam output. *It was Hall thoroughness in research which first put boiler water conditioning on a scientific basis.* It is the thoroughness in the training of a Hall Field Engineer which makes him such a valuable ally of the power plant operator.

There was a time when you might have afforded to go without such complete help. We think you'll agree that time has past. May we give you full particulars?

HALL SYSTEM

of Boiler Water Conditioning

HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH, PA.

THE PRECISION MANUFACTURING AND EFFICIENCY THAT HAVE EARNED THE . . .

Can help you PRODUCE FOR VICTORY

Naturally, Bowser is proud to be among the very first to receive the coveted Army-Navy "E" Award for the production of war goods. And, doubly proud that it can still produce the equipment that other industries find so necessary in doing their part in this War of Production. To help industry, Bowser makes lubricating systems and devices to keep machines running—meters to measure and conserve liquids—filters for many liquids—filtration systems for cutting, grinding, lubricating and honing oils and coolant solutions—pumps—wheel tanks—stills for reclaiming cleaning solvents—fueling systems for airplanes and trains—and many others. To handle liquids right—WRITE Bowser!

BOWSER
ESTABLISHED 1885

S. F. BOWSER & COMPANY, INC.
FORT WAYNE, INDIANA

WILL WATER-COOLED STOKERS PROVE BEST IN YOUR CASE, TOO?

SEVERE TEST IN OHIO PROVES WATER-COOLED STOKER RELIABILITY

Facts just disclosed by another plant (this one in Ohio) verify claims of increased reliability for Taylor Water-Cooled Stokers. The figures of this plant reveal an average burning rate of 51.2 lbs./sq. ft. during a run of 3,572 hours between May 20, 1941 and October 23, 1941. In the same period a high of 64 lbs./sq. ft. for a 24 hour run and 62.7 lbs./sq. ft. for 72 hours were attained. The severity of this trial is evidenced by the ash softening temperature (2100°F.) and the use of 350° preheated air.

Read These Excerpts of Letter from a User to an Inquirer

Gentlemen:

Our Taylor Water-Cooled Stoker is a part of a steam generating unit which has a maximum continuous rating of 150,000 pounds per hour.

The normal daily variation in load is from 70,000 to 120,000 pounds per hour. The extreme variation has been from a minimum of 25,000 to 170,000 pounds per hour.

Initial operation of this unit began in September, 1939 and the unit has been in service ninety-four per cent of the time since the aforesaid date.

We have not yet replaced any stoker tuyeres and our total charges for labor and material on stoker maintenance is practically negligible, in fact, it amounts to about seven-tenths of one cent per ton of coal.

The fuel burned on this stoker is an Ohio coal with an ash fusion temperature of 2,150 to 2,350 degrees Fahrenheit.

In general, our experience to date has been that the water-cooled stoker has more dependability for long continuous service and also has the ability to burn a greater variety of coals with a special reference to utilization of those coals which have lower ash fusion temperatures.

Advantages of Water-Cooled Grates on Mid-Western Coals:

Some of the observed advantages of water-cooled stoker installations burning mid-western coal are:

1. More uniform flow of coal, with consequent ease of distribution.
2. A more homogeneous fuel bed. Result: Better air distribution.
3. Low maintenance, supported by performance records.
4. Lower power consumption as a result of minimum clinker formation.
5. The range of fuels with low fusion ash characteristic is greater.
6. Test efficiencies are more closely approximated in regular plant operation, because of the ease of maintaining the most advantageous fuel bed contour.
7. Availability of the unit materially increased.
8. Quick chilling of molten ash particles assures a continuous and even flow of fuel.
9. Water-cooling provides an additional safety factor against possible errors in operation.

File this curve in your memory!

Because it shows the trend, we again reprint this curve of Taylor Water-Cooled Stoker sales. Refer to this curve when you want to know the trend in which power plant engineers are thinking—today as well as for tomorrow.

3-Way Improved

Although there are many ways in which Taylor Water-Cooled Stokers improve operation, these three are most important: **1. Increased reliability. 2. Increased fuel flexibility. 3. Higher operating efficiency.** Catalog W, offered in the coupon at the lower right, shows advantages, construction, and installations of Taylor Water-Cooled Stokers. Have you read it? Hundreds have. Send for it.

A-E-CO TAYLOR WATER-COOLED STOKER

AMERICAN ENGINEERING COMPANY
2408 Aramingo Avenue, Phila., Pa.

Send me without obligation a copy of the 8-page Catalog W describing Taylor Water-Cooled Stokers.

*Name*_____

*Company Name*_____

*Address*_____

*City*_____ *State*_____

3 QUESTIONS

1. Who offers the most complete line of stokers?
2. Who has built more than 17,000* stokers?
3. Who has installed enough stoker capacity to serve 5,000,000 rated boiler hp?

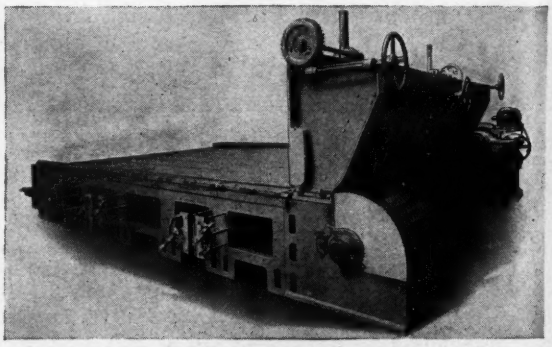
*Above residence size.

These facts that unmistakably establish C-E as "headquarters" for stokers are more than a mere statement of leadership in the field. They also assure two benefits which are gained by those companies which entrust their stoker needs to C-E.

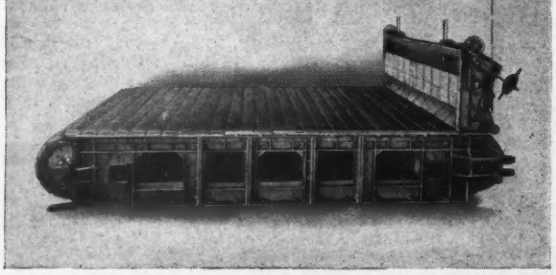
1st—*The complete line* removes any bias in favor of any particular types of stokers. It enables C-E to recommend the stoker installation which experience has established as the most suitable for your requirements of capacity, load conditions and type of available fuel.

2nd—*The vast experience* gained through building more than 17,000* stokers of all types—ranging in size from 7 to 672 sq ft of grate surface—qualifies C-E to help you determine the best stoker for your purpose and also offers assurance of proper construction and competent installation.

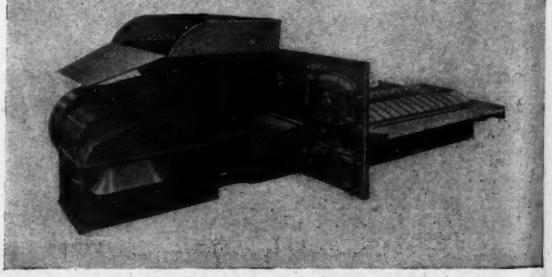
This combination of qualities..variety of stoker types and extensive experience in their application.. has won customer-confidence because it promises the greatest satisfaction in terms of efficiency, dependability and low maintenance.



C-E Chain Grate Stoker. Particularly well-suited to the use of free-burning bituminous coals. Approximate application range is from 150 rated boiler hp up to units producing 275,000 lb of steam or more per hr. Built in both forced-draft and natural-draft designs.



C-E Traveling Grate Stoker. Unequalled for burning the small sizes of anthracite and coke breeze; also well suited to lignite and some free-burning bituminous coals. Approximate application range is from 150 rated boiler hp up to units producing 200,000 lb or more of steam per hr.



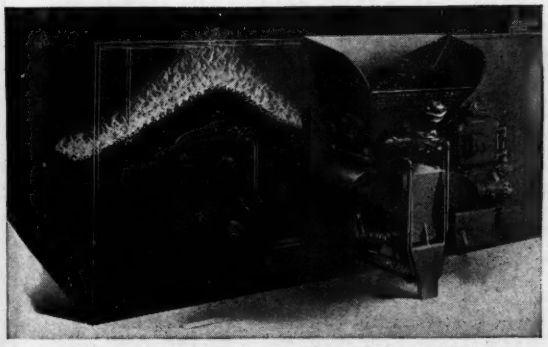
C-E Shelly Stoker. A single-retort, underfeed stoker available in designs for burning either anthracite or bituminous coal. Applicable to boilers ranging from 20 to 200 rated boiler hp. Equipped with either electric or steam drive.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR

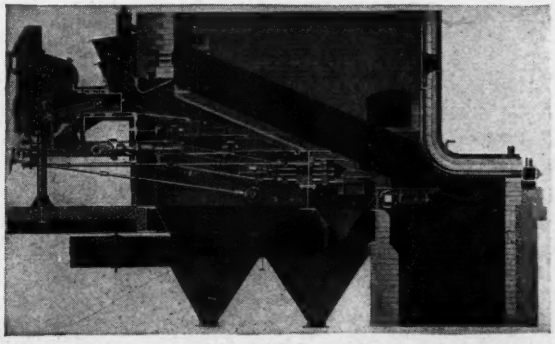
COMBUSTION

1 ANSWER

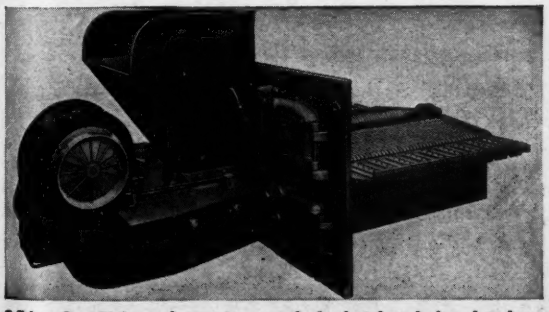
COMBUSTION ENGINEERING



C-E Type E Stoker. A single-retort, underfeed stoker designed to burn either coking or non-coking bituminous coals. Applicable to boilers ranging from 150 to 600 rated boiler hp. Equipped with integral steam piston, electric or hydraulic drive.



C-E Multiple Retort Stoker. A multiple retort underfeed stoker designed to burn either coking or non-coking bituminous coal. Approximate application range is from 500 rated boiler hp up to the largest units for which stoker firing is suitable. Equipped with steam dump, clinker grinder or continuous discharge ash trays.



C-E Low Ram Stoker. A ram type, underfeed stoker designed to burn either coking or non-coking bituminous coal. Applicable to boilers ranging from 35 to 200 rated boiler hp, especially where head room and furnace volume are limited.

C-E Spreader Stoker. A simple, rugged stoker designed to burn an unusually wide variety of coals. Approximate application range is from 150 rated boiler hp up to the largest units for which stoker firing is suitable.

A-880

Whether it's gun-barrels or boiler tubes—This is the time to

KEEP 'EM CLEAN!

Fouled gun barrels cause inaccurate shooting and wasted shells. Fouled boiler tubes cut down boiler efficiency and waste fuel. America today has no place for either.

Your boilers may be of the latest high-pressure type with tubes everywhere, including long tubes with many bends. Or your boilers may be 20 years old. You *always* need tube cleaner equipment either for regular service or as insurance against scale accumulation.

Put the job of boiler tube cleaning up to Elliott-Lagonda equipment. We have motors to fit the tubes, go around the bends and make a quick job of cleaning. We have a selection of cutter heads, drills, brushes to match any tube cleaning need whether it be ½" tubes or 20" pipes.

ELLIOTT COMPANY

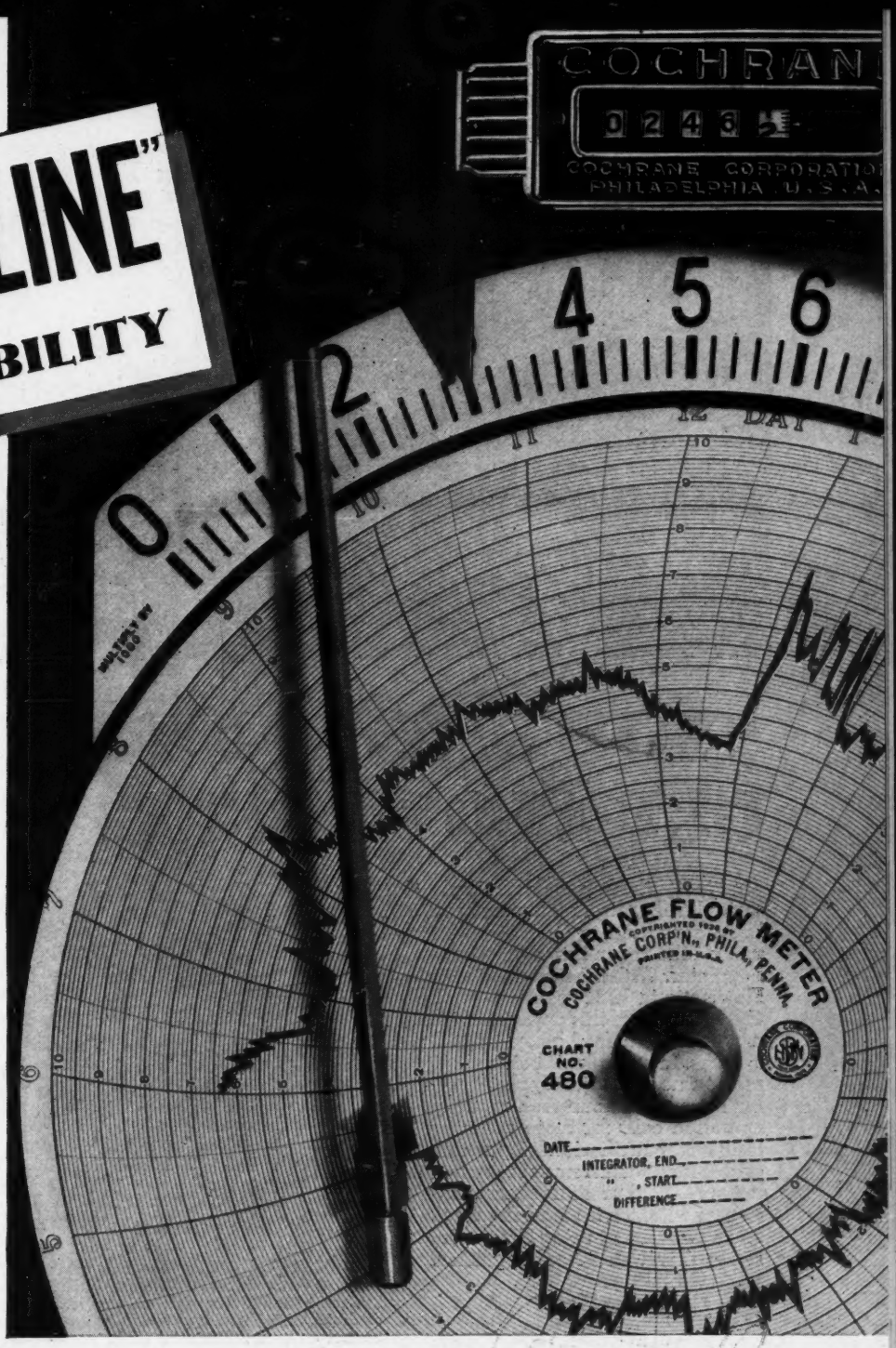
LAGONDA-LIBERTY Tube Cleaning Dept.

SPRINGFIELD, OHIO

DISTRICT OFFICES IN PRINCIPAL CITIES

Y-184

ELLIOTT-LAGONDA TUBE CLEANERS



"HEADLINE" READABILITY

Large 10" Indicating Scale—Big Red Pointer—12" Uniformly Graduated Chart—Easy-to-read Integrator

You buy a Flow Meter, as you buy a newspaper, to get the NEWS. You get it quickly from the headlines. Above are shown Cochrane's easy-reading "headlines"—integrator, indicator, pen record on chart. Long-range visibility . . . high readability.

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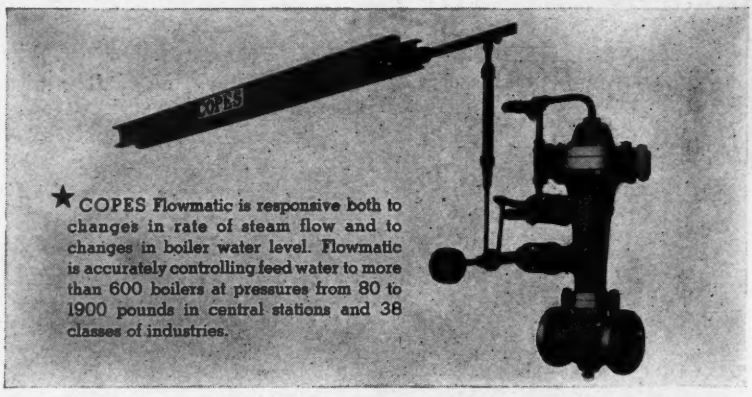
COCHRANE FLOW METERS

"YOU SAY I CAN STILL GET FLOWMATIC"

?

That is right! Many COPES simple water level control regulators have been converted to COPES Flowmatic—the Steam-flow Water-level Regulator. With the introduction of Flowmatic in 1937 we notified all COPES users of this opportunity to modernize old feed water control systems. In most plants boiler loads at that time did not justify changes—but today's 168-hour-peak-capacity operation calls for close attention to all boiler auxiliaries. It is possible to get more steam from your present boilers—hold pressures more uniform and lighten the load on pumps and governors by using Flowmatic, steam-flow water-level regulator.



★ COPES Flowmatic is responsive both to changes in rate of steam flow and to changes in boiler water level. Flowmatic is accurately controlling feed water to more than 600 boilers at pressures from 80 to 1900 pounds in central stations and 38 classes of industries.

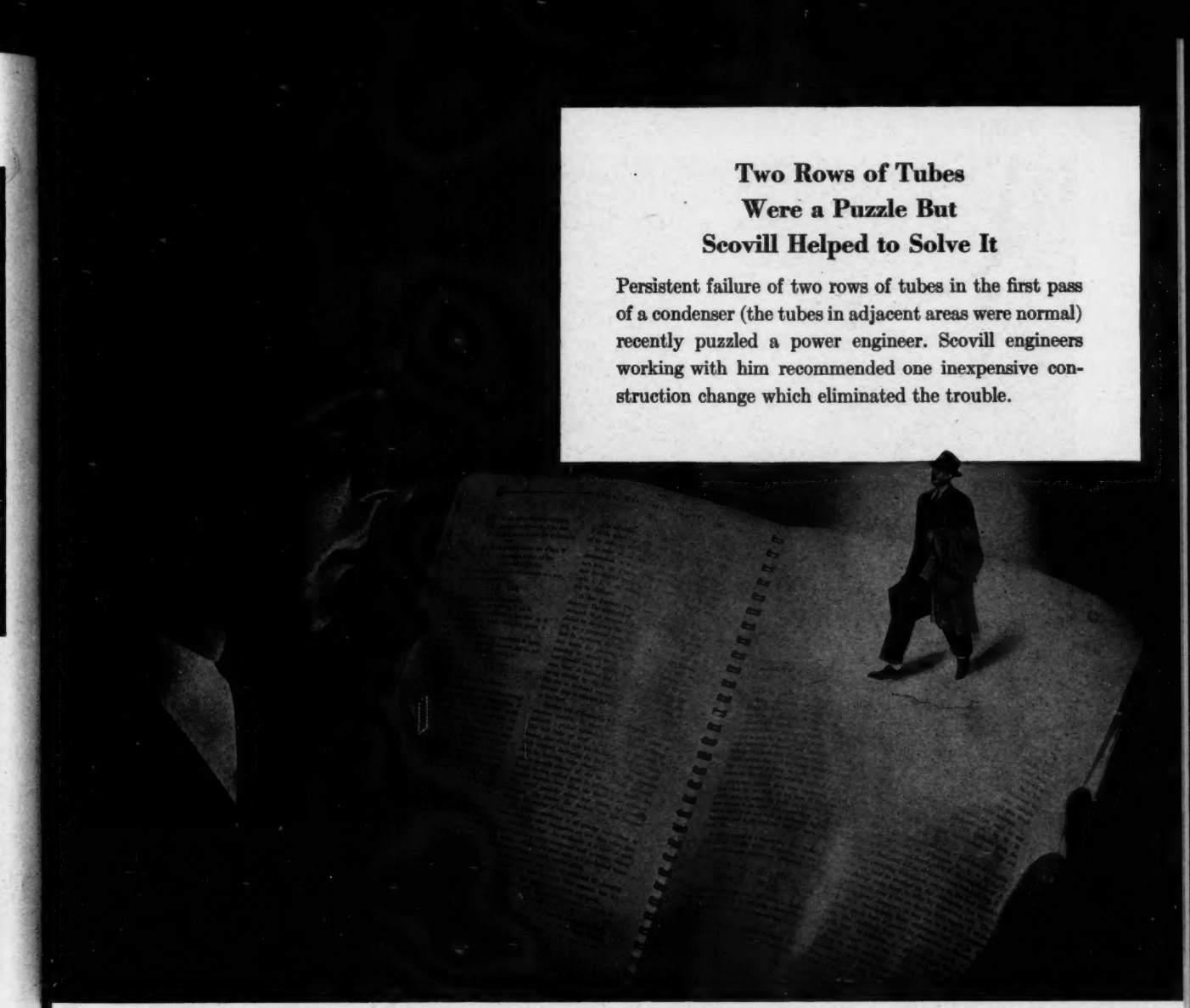
★ COPES Flowmatic, the steam-flow water level Regulator utilizes the standard COPES Thermostat and BI Valve in a compact, sturdy design that is handling boiler feed water control on over 2,225,000 boiler horsepower. Flowmatic will get more steam from your present boilers—will hold steam pressure more uniform thru continuous feeding according to steam flow. The answer to your boiler water level problem may be part of this record. May we tell you more about the possibility of converting to Flowmatic? Write today giving description of your boiler operation. Write for Bulletin 429.

NORTHERN EQUIPMENT COMPANY • 1022 Grove Drive, Erie, Pa.
Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls
Reducing Valves and Desuperheaters
BRANCH PLANTS IN CANADA, ENGLAND REPRESENTATIVES EVERYWHERE

OVER 60,000 COPES FEED WATER REGULATORS IN SERVICE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY



Two Rows of Tubes Were a Puzzle But Scovill Helped to Solve It

Persistent failure of two rows of tubes in the first pass of a condenser (the tubes in adjacent areas were normal) recently puzzled a power engineer. Scovill engineers working with him recommended one inexpensive construction change which eliminated the trouble.

Call on the man between the lines

To Help Solve Your Condenser Tube Problems

$$R = \frac{Dvp}{u} = \frac{DG}{u}$$

. . . and the combined experience of the men who serve Scovill heat exchanger customers is almost sure to equal a practical, economical solution of any tube difficulties you may encounter.

Much of this combined knowledge is contained in our new Heat Exchanger Tube Manual; but beyond that, you'll find the man *between the lines* well qualified to help you in your special problems whether it be corrosion of metals, methods of installation, fluid flow, heat transfer, or specifications.

Should that problem involve Reynolds' number . . . the transition point between viscous and turbulent flow . . . dezincification . . . vaporization . . . or merely the standard tolerances for seamless tubing . . . we can probably promptly supply exactly the information you need — background information that springs from the practical experience of Scovill consultants who have helped to solve problems like yours.

The revised edition of the Scovill "Heat Exchanger Tube Manual" is reserved for distribution to engineers and other technical men whose positions frequently require them to have access to a source of material which covers many of the more unusual aspects of heat exchanger tube engineering and operation.

★ ★ ★ ★ ★ ★ ★

For an informative source for those problems having to do with the manufacture, material selection and installation of Condenser Tubes, Scovill's Service in Manuals has produced another booklet — "Scovill Condenser Tubes" available on request. Write to Scovill Manufacturing Company, 17 Mill St., Waterbury, Conn.

SCOVILL
Masters of Metal

Scovill Condenser Tubes

ONE PRODUCT...THREE SERVICES

- **SERVICE IN MEN**
- **SERVICE IN METALS**
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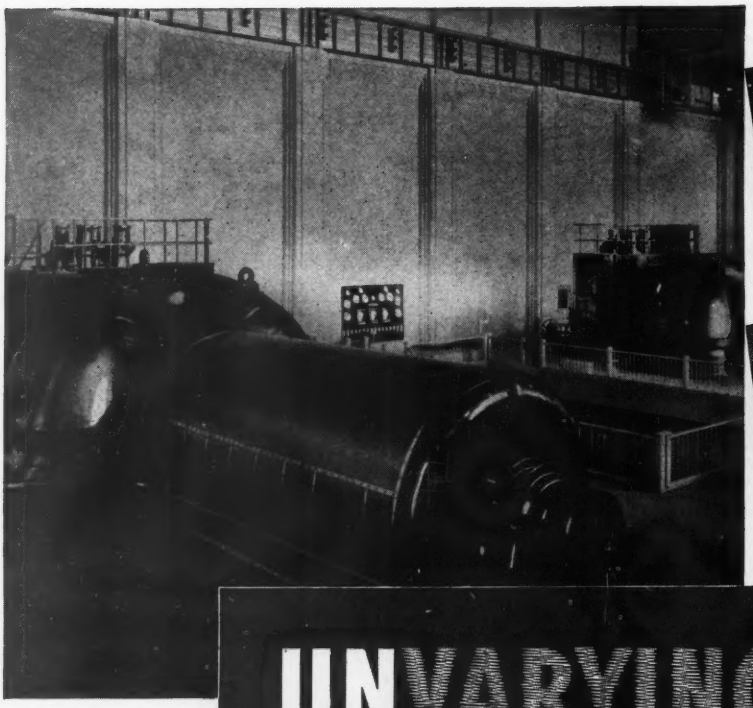
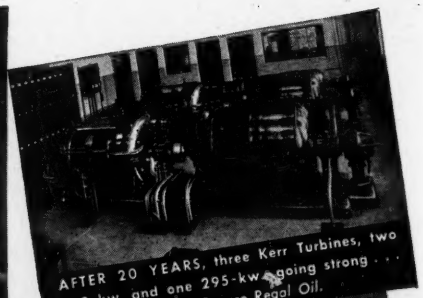


80,000 KW. units in heart of war industry section. For 10 years, largely at full load, never an abnormal temperature rise in a bearing. On *Regal Oil* from the start.



AFTER 20 YEARS, three Kerr Turbines, two 750-kw. and one 295-kw. going strong . . . as always . . . on Texaco Regal Oil.

LARGEST CYPRESS SAW MILL IN THE WORLD, operates Allis Chalmers Turbine 12 years on Regal Oil with maximum efficiency.

UNVARYING SPEED

regardless of Size–Type–Service

YOU can have the positive assurance of sensitive turbine governor action and accurate speed control . . . when you use *Texaco Regal Oils.*

These Texaco Oils *resist* oxidation, *separate* rapidly from air and water. Free from gum and sludge forming elements, they keep lubricating systems clean, bearing temperatures normal.

From small standby turbines drafted for war service to hydrogen-cooled giants, Regal Oils are helping to keep 'em on the line, delivering war-winning output.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent turbine operators everywhere.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York, N. Y.

Care for your Car ..for your Country

THEY PREFER TEXACO

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

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★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

TUNE IN FRED ALLEN
every Sunday night—CBS

TEXACO

TEXACO Regal Oils

FOR ALL TURBINES

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

POWER PLANT ENGINEERING

OCTOBER, 1942
VOLUME 46, No. 10

Cover: Inspector looking into condition of a fire tube boiler. Photo, Hartford Steam Boiler Inspection and Insurance Co.

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SPECIAL REPRESENTATIVE
George E. Andrews

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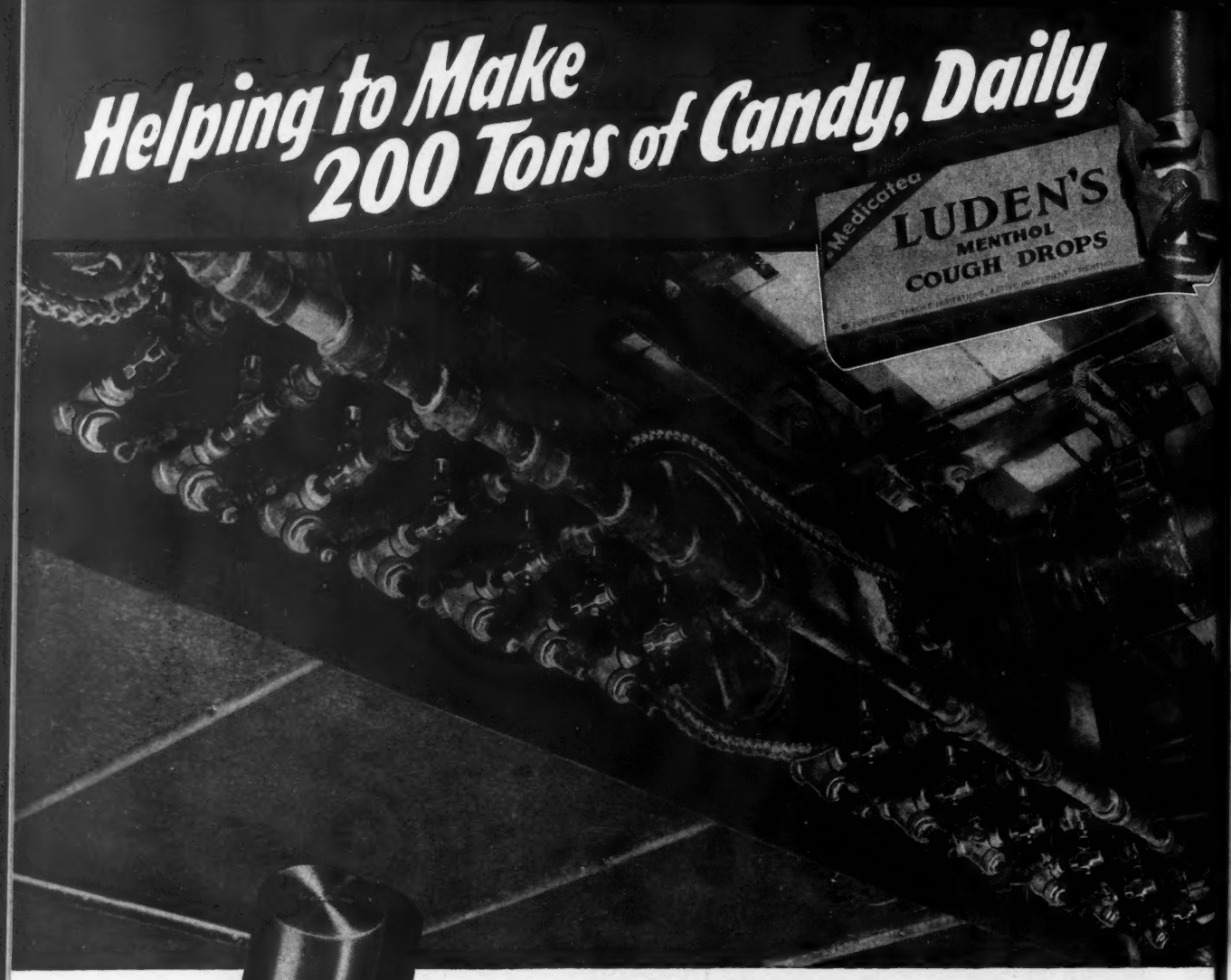
Helping to Make 200 Tons of Candy, Daily



AT the great plant of Luden's, Inc., Reading, Pa., many YARWAY IMPULSE STEAM TRAPS are on the job getting equipment hotter, sooner, and keeping it hot to speed the tremendous production of cough drops and candy.

The picture shows thirteen of these Traps, individually draining each of the heating coils of a starch conditioner. The chief engineer reports: "After three years of service, without attention, these Traps are still keeping this *dryer* at peak efficiency". Other YARWAY IMPULSE TRAPS are in use on cooking kettles, vacuum cookers and other process equipment at this plant.

More than 150,000 Yarways have been installed

Yarway Trap performance talks. *Quicker heating and greater sustained heating efficiency* soon pay for the installation and continue to return worthwhile profits in plant operating economy. When you consider that their *purchase price* is usually *no more than the cost of repairing an ordinary trap*—why not get Yarway performance for your money?

Then, too, its *small size saves space.* Its *light weight simplifies installation.* Its unique design with *only one moving part,* and its *rugged bar-stock construction,* keeps down maintenance expense. And Yarway Traps are *suitable for wide range of pressures without change of valve or seat.*

A nearby Mill Supply Dealer handles YARWAY IMPULSE TRAPS and will be glad to serve you. Or write for Catalog T-1737.

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YARWAY IMPULSE STEAM TRAPS

WHAT LEADERS SAY

War and Anglo-American Relations

By CHESTER B. MORRISON

THE evolution of the war spirit during the last 2 yr. in England may be a guide to a similar development in this country during the next year. If through their experience we can change from a peace to a war basis in less time, the war will be ended that much sooner. Dunkirk aroused England just as Pearl Harbor aroused us; that is, it disturbed us for a time but did not fully awaken us. During the evacuation of Dunkirk few people in England realized that the backbone of the British Army was suffering the most crushing defeat in the history of the empire. They did not know how close to the brink they were but they did know that their leadership had been misplaced. Up until that time the war had looked to the man in the street as the Americans viewed world affairs before last December.

At that time there was no lack of the spirit of resistance but rather a lack of strong leadership. English politics, business and society have oftentimes suffered a dearth of leaders who were willing to carry responsibility. It is also true in the past that the English have produced great leaders at the right time. An instance was Winston Churchill's appointment which swept England with a new spirit of hope in the present war.

The British people had built up the great stronghold of Gibraltar and it has stood as the emblem of Empire solidarity for over a century. In recent years they built a base at Singapore which was intended to dominate their Asiatic domain as Gibraltar dominated the Mediterranean. Whatever reverses they suffered, there was still Gibraltar and Singapore. There was also the opinion that Japan would not dare to strike in the Pacific as that would bring America into the war.

The people in England have always been conscious of the great productive capacity of the United States. They thought a declaration of war on our part would spread consternation in the camp of the enemy. They know our productive and economic capacity, but they did not realize our military and naval unpreparedness.

The success of the Japanese at Hongkong, the Philippines and Malaya, the sinking of two of Britain's most powerful ships by aircraft, and finally the fall of Singapore and Burma brought to the people of England the knowledge that they must think only in terms of war. The English learned they must sacrifice everything else they valued in order to retain the right to live under the free institution they have built up by similar sacrifice on the part of past generations.

It was early recognized that rationing would be necessary and this came about gradually. Experience in the last war was used as a guide, and many of the mistakes in rationing made at that time have not been repeated.

British labor was frozen early in the war as an effective means adopted to regulate production, and in order to freeze labor and wages it was necessary to freeze profits. Machine tools are listed by the Board of Trade and any machine tool not constantly used can be moved to another factory. Wherever possible women are replacing men. All women are registered and single women between 21 and 45 can be sent by the labor control to any part of England to work in essential industries.

In America we are now discussing the pros and cons of labor, manufacturing, rationing, and other problems, solved in England during the past 2 yr. I fully believe before we defeat Germany and Japan we will have to go as far along the lines of individual effort and sacrifice as they have done over there. Their system, while not perfect, is successful.

With a complete Allied victory there will be very few great powers in the world. China will in a few decades dominate Asia, and Russia will control Eastern Europe together with all the Slav speaking countries.

To offset such powerful States it will be essential to establish some form of agreement or confederation of English-speaking people. The British Empire alone will not again have the decisive influence that it once had and therefore will be no political match for the two great nations that will arise from this conflict. If the English-speaking countries do not stand together they will become second rate powers, but if they do stand together, the world will have to follow their leadership. The United States will be, by far, the dominant force in the English speaking group.

We have won the Latin-American countries' cooperation primarily because of our economic strength and not because of their good will. The roots of the Latin-American Countries are in Europe and with equal economic advantages offered by Europe, they would drift into a European sphere of influence. An Anglo-American confederation could perhaps bring into its sphere France, Spain and the Scandinavian countries, which would make such a powerful organization that we could again talk about a permanent peace.

The world is now ready for consolidation. If the world can be divided into a great Oriental State, a great European State, and a great English-Speaking State, then it follows that these three states can carry the responsibility of peace in the world and dominate the lesser states without depriving them of their freedom.

We now know that we will eventually win the war unless the unpredictable arises against us. The question then arises—"can we win the peace?" I believe that a confederation of English speaking states with a real spirit of cooperation and good will can be considered the answer and with such a combination we can "win the peace."

CHESTER B. MORRISON, managing director of York-Shipley, Ltd., London, England, English subsidiary of the York Ice Machinery Corp., is a native Pennsylvanian, Penn State College graduate and a member of the York 30-Yr. Club. Mr. Morrison has spent the past 22 yr. abroad. At that time (1920) he was sent to Shanghai, China, as York sales engineer, later to become president of York-Shipley, Ltd., of Shanghai upon its formation. An officer in the Engineers during the first World War, he has had an opportunity to observe Jap tactics in China as well as having been a resident of London since 1940 and throughout the blitz. Material presented on this page is an abstract of a talk given by Mr. Morrison before the Rotary Club of Rochester this summer.

Kilowatts From The Wind

After almost one year of experimental operation in parallel with the lines of the Central Vermont Hydroelectric Corp., the noted 1000-kw. Smith—Putnam wind-power generating plant on Grandpa's Knob near Rutland, Vermont, is reported to be generally satisfactory, structurally, mechanically and electrically. As told in greater detail on page 78 of this issue, preliminary experience with this first large wind-power unit points to the probability of obtaining energy from the unit for at least 50 per cent of the time. Invented by Palmer Cosslett Putnam and carried to completion by the S. Morgan Smith Co. this is the first serious attempt in this country to harness the forces of the wind in the production of electric power. The blades of the wind turbine weigh approximately 8 t. each and have a total wing spread of 175 ft. Normal speed of the rotor is 28.7 r.p.m.

WITH THE EDITORS

◆**SCRAP** . . . In the current campaign for the collection of scrap we are drawing on a hidden resource but one which is nevertheless of great value. In normal times the utilization of scrap, metal or otherwise, is more or less of a necessary evil. It accumulates and so something has to be done with it but in nearly all cases manufacturers would rather use new raw material than scrap.

In time of war, however, when all sources of raw material are used to the limit, scrap comes into its own. Despite difficulties in reclaiming and the cost and effort of collecting, manufacturers are only too glad to get hold of scrap in their efforts to meet the war needs. Hence, the current campaign.

◆**SCRAP POWER** . . . The considerations involved in the use of scrap in the present war effort have an interesting parallel in the generation and use of power. True, in the case of power there is no such thing as "scrap power" but there is something very similar to it in the power that is wasted as a consequence of inefficient operation.

While it is the aim of every good engineer to generate and utilize power efficiently, in practice it is almost inevitable that certain types of power losses occur. As loads grow, due to the addition of new equipment, conductors which originally may have been large enough to carry the load when the installation was made become overloaded; the addition of large numbers of small induction motors tends to lower power factor; changes made in machine drives and conservatism in selecting new motors gradually bring about the condition known as overmotoring. These electrical losses have a definite value in that they constitute a source of power which is ordinarily not considered in any estimate of the nation's power resources.

Last month, it may be recalled, we reported the fact that the War Production Board had halted work on the construction of 85 power plants which were scheduled for completion in 1943 and 1944 and which involved a total of some 2,200,000 kw. This move, therefore, leaves us short of just that much potential generating capacity and while the move was no doubt expedient from the standpoint of the critical material it releases for other uses, still it is only obvious that this amount of power can hardly be spared.

◆**OVERMOTORING** . . . Take the question of "overmotoring." Overmotoring not only results in increased power consumption and lowered power factor but, in the case of new installations being made today, it is wasteful of critical material. In a recent statement, L. A. Umansky, assistant manager of General Electric's industrial engineering department, pointed out that because of overmotoring, up to 25 per cent more material and labor are going into the production of motors than is needed for the work the motors are being called upon to do. Motor users and specifiers he indicated could help greatly in conserving critical materials by selecting motor sizes on the basis of the actual expected duty without overstressing additional safety factors to take care of unexpectedly heavy loads or to lengthen motor life. The conservatism which enters into our selection of motors in normal times must be discarded for the duration. Aside from the actual material involved in the construction of the motor, the practice of overmotoring, Mr. Umansky pointed out, affects almost everything else in a plant's electric chain including control, distribution, and generation.

In any electrical installation, only a small portion of the copper used is contained in the motor windings. The bulk is in the distribution system, in the cables, buses, etc. Consider, for example, an average industrial plant with an installed capacity of say 10,000 hp., mostly in squirrel-cage motors and designed for 4000 kv-a. capacity, that is, 40 per cent load factor. An average 7½ to 10 hp. squirrel-cage motor requires not more than 2 to 3 lb. of copper per horsepower. Under the most ideal conditions up to 5 lb. of copper will probably be needed for each installed horsepower. If, in a case of this kind, motors are selected which are 15 to 25 per cent too large in addition to needless use of materials and facilities in motor manufacture, the amount of excess distribution copper is likely to be from 7500 to 12,500 lb.

These figures are based on the most favorable conditions—it assumes high voltage distribution throughout the plant—and the excess copper used would be much more if an old-fashioned distribution system of carrying the power through the plant at low voltage were used. If 220-v. motors were chosen instead of say 440-v. the distribution copper would go up to 10 lb. per hp. with a load center system of distribution and up to 18 to 20 lb. with an old-fashioned system.

◆**LOW POWER FACTOR** . . . Low power factor is intimately tied up with overmotoring since it is a characteristic of an underloaded induction motor to operate at low power factor. Low power factor is the result of other causes as well, however, and it has its own remedies, one of which is the installation of capacitors.

The installation of capacitors can actually increase the amount of power available. An interesting analysis made by engineers of the General Electric Co. recently showed that the installation of 7,500,000 kv-a. of capacitors would release 2,500,000 kv-a. of additional power released for the war effort. This estimate is made on the basis that each kv-a. of capacitor will release 1/3 kv-a. This is a conservative estimate, since each kv-a. of capacitor in practice, releases from 1/3 to 1½ kv-a. of load-carrying capacity. The amount of kv-a. released depends, of course, upon the nature of the load and the particular part of the system involved. Seven and one-half million kv-a. of capacitors could be installed during the next year.

The kv-a. released by the installation of capacitors, furthermore, will be over-all system capacity — capacity available at the point of utilization rather than increased generating capacity. In other words the utilization of these 2,500,000 kv-a. requires no additional transmission or distribution lines. The use of capacitors in this manner by reducing the losses can reduce the kilowatt demand and save kilowatt-hours, the reduction in kilowatt demand means that additional capacity is released for productive work. Even by conservative calculations, the installation of 7,500,000 kv-a. of capacitors on our power systems will—on peak—reduce the losses by 1,000,000 kw. It would reduce the energy losses by 4,200,000,000 kw-hr. a year.

A matter of 2,500,000 kv-a. when translated into terms of production is not a small item and, therefore, well worth saving. This amount of power would operate over 300 manufacturing plants the size of one of our largest bomber factories. It would produce four million pounds of aluminum every 24 hours, enough for 400 large bombers or it would supply more than five times the power needed for all cantonments in the country.

◆**COOPERATION** . . . The recovery of these electrical losses is a problem very much like the collection of scrap; it requires the attention and services of all of us in the power industry. Just as it is necessary for us as individuals to look around our houses for scrap metal so it is necessary for us as engineers to look around our plants to see what "scrap" power is lying around. Check up on your motors; determine whether they are running underloaded and if they are see whether by re-arrangement they cannot be better suited to their loads. Check the power factor of your systems and if it is low take what steps you can to raise it. If you are making new motor installations, analyze the load conditions very carefully and do not order motors larger than are strictly necessary to carry the load. You may have only a small plant and the individual saving in power effected may be quite small in some cases but it will be worth while and you will be contributing directly to the war effort.

Fig. 1. Parker Dam, an achievement of cooperation between engineer and architect

Metropolitan Water District Photo

Character and Distinction

by Daniel A. Elliott

LOOKING over the field of industrial architecture today uncovers few structures which impress one with their character and distinction. This fact may not be questioned by many, rather it is accepted as a natural consequence of our machine age. Those individuals may reason that, if a plant is functional and is efficiently producing the result for which it was designed, then it is wholly successful.

Beauty in a steam plant, pumping station or various kinds of industrial plants, they believe, cannot be attained at moderate cost, and to increase the expenditure for aesthetic values would be quite unjustifiable.

Now, this is not only the average man's opinion but also shared by many engineers who are in charge of producing the plans and specifications for these industrial plants. It does not occur to them that character and distinction are often obtainable through the skillful shaping of mass, careful controlling of voids, and intelligent selection of materials, and this at little or no extra cost.

Savings Through Simplification

In fact, there are instances where savings have been effected and the architectural design improved through the process of simplification. One pertinent example was the redesigning of the architectural treatment of Parker Dam on the Colorado River. Some 1000 yd. of concrete were saved through the adoption of a simplified design, in preference to the design submitted by the engineers.

There are many plants in existence today, some constructed at a relatively recent date, and that with benefit of architect, which cannot be classed as good architecture. The architect apparently had no conception of the engineer's problems and made no effort to express the function of the plant.

How many hydro-generating plants are there which would look remarkably like large banking institutions or union stations were it not for the generators and other equipment in sight? In fact, it is the equipment which seems to be out of place. Quite obviously the engineering and the architecture are not playing the game together.

As far as the architects are concerned, this situation is rapidly improving, particularly since the advent of the so-called modern style. However, there are far too many architects who are content in expressing function without any serious attempt to create a structure which might also be classed as beautiful.

The Rube Goldberg Class

There are also numerous plants being constructed, without benefit of architect, which, from an architectural point of view, are definitely in the Rube Goldberg class. They seem to be a highly complicated and grotesque mass of pipes, valves, motors, pumps, boilers, etc., etc., ad infinitum—a veritable mechanical engineer's nightmare. They may function satisfactorily, but they are not an aesthetic asset to the community.

It is not difficult to imagine that such plants would actually benefit from an engineering point of view by a process of simplification, grouping similar elements, and perhaps housing the more complex and intricate assortment of valves, gages, controls, etc. It has always seemed to me that if a piece of equipment is properly designed, it will appear clean cut, more or less simple, and have a certain degree of successful dignity.

It may actually attain some degree of beauty, even though the designer did not consciously work

[1]See California Goes Modern, POWER PLANT ENGINEERING, September, 1940, p. 52, also Burbank's Modernistic Design Gives Low Cost and High Efficiency, by J. B. Johnson, December, 1940, p. 54.

toward that end. Some engineers definitely have a sense of architectural design. This may be either natural or acquired through study of architectural appreciation.

Now, all this brings us to the question: Should industrial architecture have character, distinction and beauty? Most of us will admit that it should express the character of its function; also, that it should have the appearance of achieving its end without too great an effort; thus adding dignity to the piece of equipment or to many pieces of equipment combined to constitute a great industrial plant. It may be a short step from this to real beauty.

Industrial plants form no small part of our large cities. Many of them are necessarily placed in close proximity to our better residential and business districts. Would it not add much to our civilization and culture if these

in Industrial Architecture

plants could claim an aesthetic as well as a utilitarian value?

To design an industrial plant which might be considered genuinely beautiful comes to the lot of very few architects; it is a difficult thing to do. This does not release the architect from making a serious attempt in that direction, for his efforts can produce a structure of interest and dignity; this perhaps can be called some degree of beauty. His work today is made increasingly arduous since he is no longer the masterbuilder he was during the Middle Ages and Renaissance.

In that golden age of architecture, the engineer and architect were one and the same person. The great Gothic cathedrals, Roman baths, aqueducts, etc., were structurally sincere and truly masterpieces of architecture. These architects engineered their buildings with an eye to beauty as well as to function. There were times when the architect's demands on engineering were hard to meet, in order to satisfy his ideas of beauty.

Brunelleschi, the great Florentine architect, dreamed of raising the huge dome of the Cathedral of Florence into the air on a drumlike structure. This was unheard of at that time, but the engineer in him did not falter; the great iron chain which binds the base of the dome to take the thrust of the mighty pile of masonry above, was forged into place. Thus, another immortal masterpiece was born through the fortunate combination of engineer and architect.

In modern times the architect does not have this tremendous advantage, unless he is consulted before any plans have been made and then works in close liaison with the mechanical, electrical, and structural engineers. This is vital, since the beauty of an industrial plant is a functional beauty and begins to develop when the design is first conceived.

To call in an architect at the last minute and have him cloak the structure with so-called architecture is to have him produce a design which is dishonest. This result is not only displeasing to him but also to most engineers.

Plain and Fancy Architects

Some engineers are suspicious of architects and are convinced that their assistance will not only add materially to the cost of construction, but will create too ornate a design. They believe that all architecture can be placed in two classes or styles—plain and fancy, and that the work of the majority of architects falls in the latter class.

There are grounds for this belief, if we consider only the work of architects previous to the advent of the modern era. We have but to contemplate the Greek temples stacked one above the other in New York City in a vain attempt to produce a successful skyscraper design. The engineers were far ahead of the architects during this period; architectural designers had not yet learned to express modern building materials in their design.

In Many Cases Designs Were Too Fancy

This deficiency in design ability on the part of architects is strikingly noticeable in industrial design. Here they were at a complete loss to know what to do and hence fell back on the academic styles with which they were familiar. Renaissance pump halls and Gothic power plants began to blossom. It became almost impossible to express the true character and function of these buildings, and in some cases the result was indeed too fancy.

This situation no longer exists as practically every architect today has learned the lesson of functional design and is only too anxious to apply it. It should be noted here, however, that there are powerful factors that influence an architect other than engineering requirements.

There are boards of directors, heads of public service departments, and the like, who have very definite architectural ideas. These ideas often conflict with the better judgment of the architect, but nevertheless, they must be given consideration.

With some few exceptions, the engineer is responsible for producing the plans and specifications of industrial plants. Hence, he is responsible for their appearance and should realize that he must do more than produce a good engineering design. Now, it does not necessarily follow that plants designed by an engineer cannot also be good, architecturally speaking. On the contrary, as I have pointed out, they may be very good, either by accident or through the design ability of the engineer, but these cases are few.

Why in this time of critical materials, of speed and confusion should we bother with an article on character and distinction in architecture? The answer is simple. Neglecting the strictly war industries destined for wrecking after the war, power plant structures being built today will stand for many years as a monument or eye sore to the war period. Proper cooperation of engineer and architect will pay dividends in money, appearance and functional value, as far removed from the marble temples of the twenties as from the conventional shoebox with a few windows. As architect of the Glendale and Burbank plants[1] and of the Metropolitan Water District of Los Angeles, the author speaks with knowledge and authority. He has demonstrated many times, what can be done, not only to meet, but to better, the engineer's functional requirements

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Nor does it necessarily follow that a structure which is engineered properly is consequently a thing of beauty. On the other hand, we do know of famous buildings which, although they are wasteful of materials, have stood the ravages of time and vicissitudes of fortune and are universally considered good architecture. The Parthenon, held by architects to be the most beautiful building ever constructed, is not entirely honest from a design standpoint and not strictly functional from an engineering standpoint.

The dentils, triglyphs, and metopes are all relics of the time when Greek temples were constructed of wood, and the columns are designed to be well proportioned and pleasing rather than to carry the loads imposed on them. So, we must conclude that good engineering is not synonymous with good architecture; and good architecture can, under certain conditions, be extravagant of materials and to some extent dishonest in design. Beauty is a subtle thing and no absolute rules can be laid down for its achievement.

Of course, a modern industrial plant is much more exacting of the engineer and architect. There can be no extravagance nor dishonesty in a successful plant design. This fact tends to complicate the problem and make it most difficult for both designers, and most essential that both appreciate and assist each other.

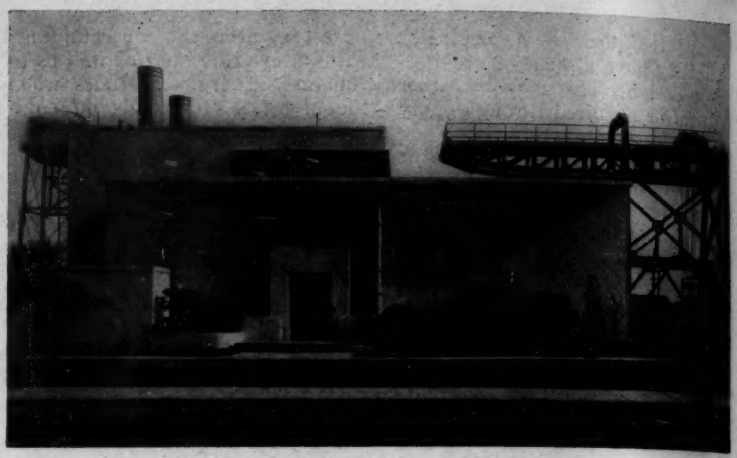

Fig. 2. Exterior of the Burbank (Cal.) municipal power plant, a semi-outdoor structure designed for utility and low cost. The outdoor turbine setting is shown by Fig. 5

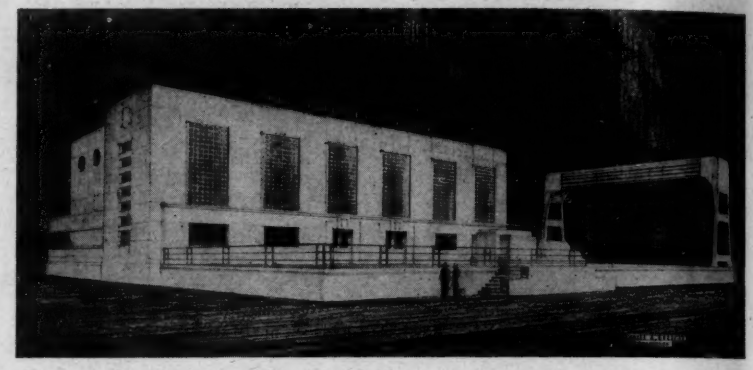

Fig. 3. Architect's sketch of Glendale (Cal.) municipal power plant, similar to Burbank in general appearance but radically different in detail to accommodate different equipment

Metropolitan Water District Photo

Fig. 4. Interior of the Iron Mountain Pumping Plant. The modern streamlined simplicity of this utilitarian design contrasts sharply with architectural treatment of a few years ago

The architect is not only concerned with securing a plant that is pleasing in appearance, but he wishes to have a well coordinated and efficiently functioning floor plan. He is a specialist in the proper selection of materials for floors, walls, exterior surfaces, etc., and his knowledge of many other items is extensive and practical.

Every plant of any consequence should have at least four major divisions in its plans and specifications. There should be the mechanical, electrical, structural and architectural plans. The preparation of the architectural plans should be under the direct supervision of an architect.

These plans can and often do serve to coordinate the work of the major engineering divisions, and in addition include the many various items that are not properly a part of the mechanical equipment, electrical layout, or structural frame. The engineer in charge will find this procedure very helpful.

From an architect's standpoint, there are some very encouraging signs. A large portion of Government work done under the T.V.A. and the Bureau of Reclamation has been designed with the aid of an architect. Huge Boulder Dam may not seem to be an architectural problem, but there are spillways, intake towers, elevator headhouses, and the vast power plant at its base with its motors, cranes, panel boards, doors, railings, and floors which have been given careful architectural consideration.

Fig. 5. Outdoor turbine housing showing how the architectural treatment harmonizes with the simple yet effective and attractive building design

This fact in no small way contributes to the impressiveness of this modern engineering miracle. Municipalities, water districts, and large corporations are beginning to appreciate the value of an architect. Instead of being a useful but definitely unattractive structure, an industrial plant may be a dignified asset to the community—a job of character, distinction, and efficiency.

Air-Blast Station Circuit Breaker Designs

Air-blast principle has fully demonstrated its effectiveness and now, 15-kv. breakers are available in ratings that well exceed one million kv-a. The arcing time of the air-blast breaker is held to approximately one-half cycle on interrupting ratings with consequent low rate of deterioration

By A. C. BOISSEAU
Power Circuit Breaker Division
Philadelphia Works, General Electric Co.

SINCE the first high-capacity station type compressed air circuit breakers were demonstrated in 1939, simplification and perfection of this type of circuit interrupter has continued steadily and today there are many of them in service, and a large number in various stages of manufacture. These breakers, when the line is completed, will cover the entire range of ratings at 15 kv. from 500,000 to 2,500,000 kv-a. with continuous current ratings as high as 5000 amp.

The first 15-kv. breaker was placed in service during November of 1939, and has performed with complete satisfaction both from the viewpoint of interruption and absence of deterioration of contact and arc chute components. Operating experience is so far confined to the 500,000 and 1,000,000 kv-a. ratings, but field tests have demonstrated the excellent performance of the 1,500,000-kv-a. breaker.

The 1,500,000-kv-a., 15-kv. breaker illustrated here was used for field tests at the Hell Gate Generating Plant of the Consolidated Edison Co. of New York and is typical of the general arrangement of this type breaker. In these field tests the breaker successfully interrupted various values from 200,000 kv-a. to more than 1,500,000 kv-a. (the breaker rating) in considerably less than 8 cycles (the standard interrupting time rating). Arcing never exceeded one-half cycle, so that burning of contacts and arc chutes was quite light and, even after this severe short circuit duty, were still in good enough condition for several times as many operations as they received during the test.

The operating pressure of 250 lb. utilizes fully the advantages of the air-blast breaker. The results of both factory and field tests have shown that at this pressure the arcing time is held to approximately one-half cycle on all interrupting ratings with a consequent low rate of deterioration of contact and arc chute components.

The arc chute has a unique air baffle in order to eliminate the discharge of incandescent gases around the movable contact. This baffle consists of a section of the chute into which part of the main blast air is led and through which the moving contact passes as it is withdrawn from the arc chute. Since the pressure differential between this chamber and that containing the hot gases is relatively low the discharge follows the path of least resistance, through the chute and out the exhaust muffler.

Fig. 1. Front view of 15-kv., 1200-amp., G.E. air-blast circuit breaker. Three exhaust tubes from the arcing chutes are combined into a common header at the base of the mechanism compartment making the mechanism readily accessible

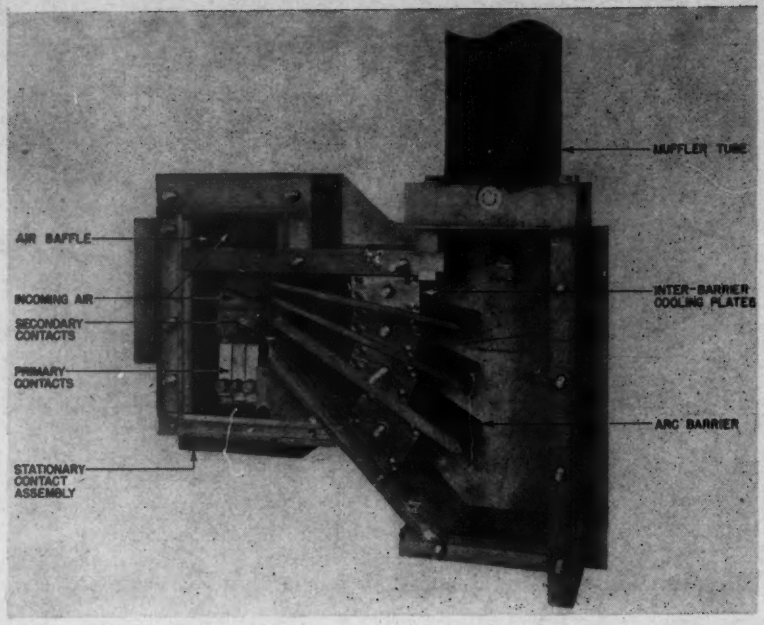

Fig. 2. Arc chute of 15-kv., 1200-amp. breaker opened to show the details of construction

The operating mechanism is pneumatically actuated to both open and close the breaker. A direct mechanically operated blast valve is used. This arrangement is simple and positive and gives complete assurance of synchronized action between the two.

Every precaution has been taken to prevent operation of the breaker at air pressures below that at which it will function satisfactorily; first, by means of sensitive pressure switches that supervise the control circuits and, secondly, by a direct mechanical interference that prevents motion of the mechanism.

Briefly outlined the operation of the breaker is as follows:

To *close* the breaker the solenoid coil of the closing control valve is energized, admitting air to the closing side of the operating cylinder. The first motion of the piston lifts the latch and then through a simple linkage the motion is transmitted to the movable contacts. Prior to the contacts meeting the blast valve is opened mechanically for a short interval of time to delay the voltage flashover and control the point at which it strikes. On completion of the stroke the breaker is locked closed by means of the same latch that held it in the open position and the coil of the control valve is de-energized by a mechanically operated cut-off switch.

To *open* the breaker the solenoid coil of the opening control valve is energized, admitting air to the opening side of the operating cylinder. The motion of the piston operates the blast valve first and then lifts the latch releasing the breaker mechanism. The movable contact is then withdrawn from the arc chute and the blast valve closed. On completion of the stroke the latch locks the breaker open and the coil of the control valve is de-energized by a mechanically operated cut-off switch.

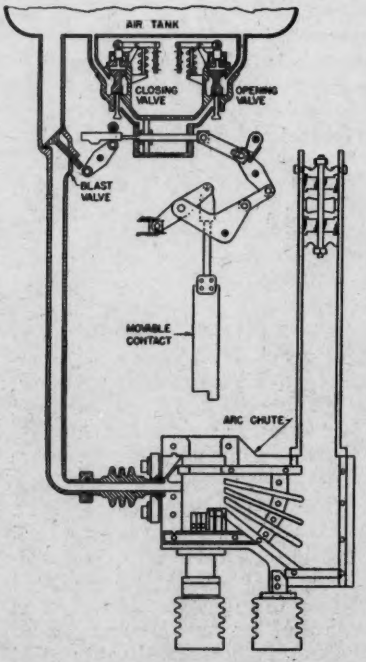

Fig. 3. Schematic diagram of the air-blast circuit breaker

EXPANDS TRAINING PROGRAM

General Electric has expanded its training program to teach military men and its own employes how to maintain in the field the great variety of war devices, many of them new and highly technical, which the company is making in vast quantities.

Vice-President Roy C. Muir, chairman of the company's education committee, explains that Navy men are being given instruction in the care of submarine propulsion equipment; British and Canadian as well as Army and Navy airmen are being taught maintenance of airplane equipment for high-altitude flying; and that both Army and Navy men are learning the care of radio equipment, searchlights, gun controls, airplane locators, and similar devices.

Graduates of some of these courses are now in England, Hawaii, Africa, and India, and the number is constantly increasing. The civilian engineers travel in trans-Atlantic and trans-Pacific planes and take many of the risks of soldiers to keep equipment functioning where it is needed.

In the majority of courses, teachers are taught who in turn will go out and train hundreds of others. Every effort is being made to keep instruction abreast or ahead of production to insure proper use of equipment when they reach the scene of action.

This is a war of science. A new type of engineering is required. Electrical machines and circuits must be co-ordinated with highly complex mechanical mechanisms, optical systems, and radio.

All that has been learned in the last 20 yr. about electronics, frequency modulation, television, and high-frequency phenomena is now being applied to the airplane and warship. Lightweight instruments, generators, motors, complicated control systems, armament, and ignition systems have been designed to withstand vibration and to operate in planes from sea level to high altitudes under widely varying humidity and temperature conditions.

Electrification of a warship has become much more complete and complicated. Automatic controls, shockproof mounting, mine protection, radio communication, signalling, and detection are among the things requiring highly trained men.

Part II. Typical methods of water conditioning as employed in modern high-pressure plants are outlined in this the concluding article of the series. The author treats specifically the characteristic results obtained from evaporators, hot-process water softeners and Zeolite softeners. Part I of this series dealing with objectives was published in the September, 1942 issue

Conditioning Feedwater For High-Pressure Boilers

By Austin C. Dresher, Cochrane Corporation

THE requirements of satisfactory feedwater conditioning having been stated in Part I of this two-part article, the means available for meeting them will be enumerated, namely:

1—Evaporators.

2—Hot-process water softeners, with various treating agents:

(a) Lime and soda ash and supplementary phosphate, which combines external treatment by lime and soda ash with phosphate for internal treatment.

(b) Lime, soda and secondary phosphate, which combines external treatment by lime and soda with external phosphate treatment.

(c) Phosphate and caustic soda.

(d) Phosphate and magnesium salts.

(e) Phosphoric acid, caustic soda and magnesium salts.

(f) Lime, gypsum and supplementary phosphate.

(g) Lime, magnesium salts and secondary phosphate.

3—Zeolite softeners.

(a) Without pre- or post-treatment.

(b) Pre-treatment with lime for reduction of carbonates, or with coagulation or clarification.

(c) Post-treatment with acid.

(d) Use of carbonaceous zeolite, combining the acid and the sodium regenerating cycles.

Evaporators

Evaporators, properly operated, produce a superior quality of water and are the accepted means for preparing small quantities of make-up in central stations. They have been used in industrial plants as transformer evaporators to supply boilers operated at 1200 to 1500 psi., but, because of the degradation of heat inseparable from the operation of an evaporator, with the accompanying loss of by-product power, there is an increasing trend toward chemical methods of water conditioning, such as the hot-process water softener with external phosphate treatment, and carbonaceous zeolite with both acid and sodium regeneration. Consideration is also being given to the combination of cation and anion exchangers, which will remove all minerals from the water with the exception of silica, thus nearly duplicating the results of distillation. Even with evaporators, care must be taken to minimize carryover, as it introduces impurities into the make-up and may result in unfavorable conditions, such as fouling of turbine blades, particularly so when silica forms a high percentage of the evaporator concentrate.

Hot-Process Water Softener

The hot-process is applied in various ways, the most common being lime and soda treatment followed by an internal treat-

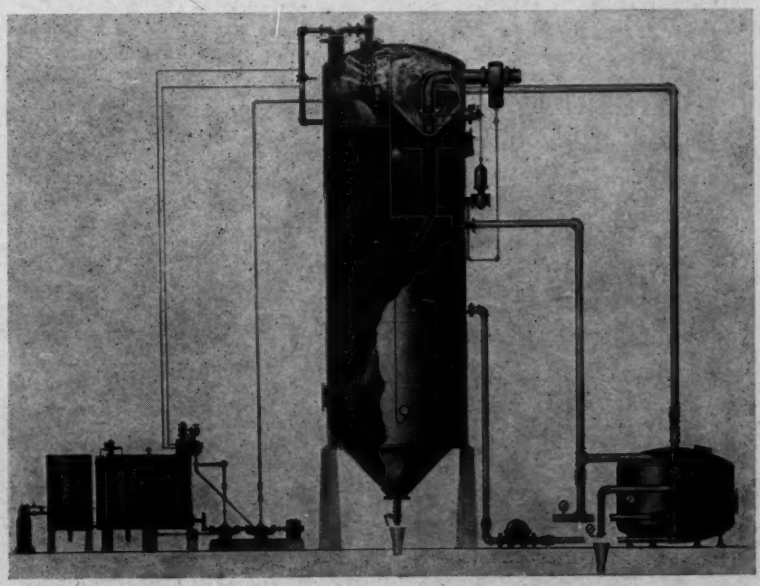

Fig. 3. Typical hot-process water softening system

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ment with phosphate fed directly into the boiler. This is perhaps the most common method of treatment for boilers carrying pressures up to and including 900 psi. Figure 3 illustrates a typical hot-process water softener of approximately 100,000 lb. per hr. capacity, incorporating lime and soda treatment, as well as deaeration.

Reduction of Silica

The hot-process softener is also well adapted to use various other reagents, such as lime and gypsum for reduction of high sodium carbonate, the gypsum reducing the sodium carbonate and converting it to an equivalent quantity of sodium sulphate. As generally the magnesium content of water supplies may be appreciable, the precipitation of magnesium by means of lime provides an excellent means for reducing the silica. Figure 4 shows test results taken from the records of

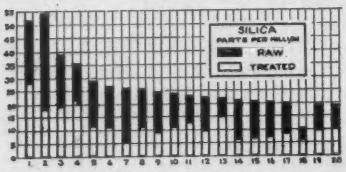

Fig. 4. Results of tests in the reduction of silica by lime and soda ash in a hot-process softener

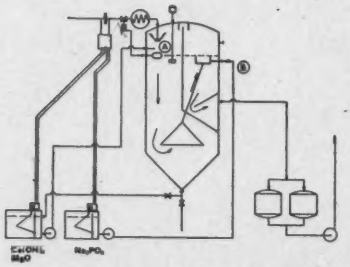

Fig. 5. Diagram of hot-process softener combining two-stage water softening with silica removal

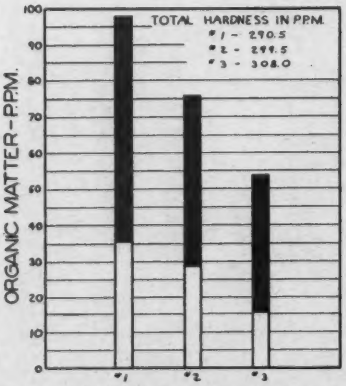

Fig. 6. Reduction of organic matter in hot-process softener

Chemical Reactions with Carbonaceous Zeolites

SODIUM CYCLE

SOFTENING

(1) $\left.\begin{matrix}Ca(HCO_3)_2\\Mg(HCO_3)_2\\CaSO_4\end{matrix}\right\} + Na_2Z \ldots\ldots\ldots\ldots \left.\begin{matrix}Ca\\Mg\end{matrix}\right\} Z + \begin{matrix}2NaHCO_3\\Na_2SO_4\end{matrix}$

REGENERATION

(2) $\left.\begin{matrix}Ca\\Mg\end{matrix}\right\} Z + 2NaCl \ldots\ldots\ldots\ldots Na_2Z + \left.\begin{matrix}Ca\\Mg\end{matrix}\right\} Cl_2$

ACID CYCLE

SOFTENING

(3) $\left.\begin{matrix}Ca(HCO_3)_2\\Mg(HCO_3)_2\\Na(HCO_3)\\CaSO_4\\2NaCl\end{matrix}\right\} + H_2Z \ldots\ldots\ldots\ldots \left.\begin{matrix}Ca\\Mg\\Na_2\end{matrix}\right\} Z + \begin{matrix}H_2CO_3\\H_2SO_4\\2HCl\end{matrix}$

REGENERATION

(4) $\left.\begin{matrix}Ca\\Mg\\Na_2\end{matrix}\right\} Z + H_2SO_4 \ldots\ldots\ldots\ldots H_2Z \left.\begin{matrix}Ca\\Mg\\Na_2\end{matrix}\right\} SO_4$

a number of plants. The average reduction of silica by the use of lime and soda ash is approximately 60 per cent. Where further reduction is required, it is only necessary to add Dolomitic lime or magnesium oxide.

With lime and soda treatment, hardness is reduced to the order of ½ to 1 gr. per gal. Where this is to be further reduced, and for boilers carrying high pressure, as 1500 psi., a secondary treatment with phosphate reduces the hardness to practically zero, that is, to approximately 1 to 2 p.p.m.

Figure 5 illustrates a typical installation, which provides 10 per cent of make-up for 1500 psi. pressure boilers. The water is first given a lime treatment for precipitation of most of the hardness, which is followed by a phosphate treatment in a separate compartment to reduce the hardness to zero.

Phosphate Treatment

For handling very soft water supplies, that is, of 50 p.p.m. hardness or less, the lime and soda treatment can be dispensed with and only phosphate treatment used, employing trisodium phosphate or phosphoric acid and caustic soda.

Figure 6 is typical of results obtained by a hot-process softener in the removal of organic matter; much of the organic matter is eliminated, lime being an excellent scouring agent. This is particularly desirable in treating water from streams polluted with sewage, etc. It does not, however, apply to organic matter carrying color, such as tannins, as these have a tendency to hold the hardness in solution.

Zeolite Softeners

For the treatment of water to be fed to high-pressure boilers, the carbonaceous type of zeolite is now generally regarded as acceptable. Carbonaceous zeolites include two types, namely: (1) those produced from a high-volatile base, such as bituminous coal; and (2) resinous zeolites formed through the reaction of formaldehyde and carbolic acid. The coal base zeolites are produced by the sulfonation of volatile constituents of the coal, as for example by the reaction of 5 parts of sulphuric acid with one part of coal, the sulphur combining with the carbon to form the zeolite.

The resinous products are formed in a manner similar to the manufacture of other resinous and plastic materials.

Zeolites are now often favored, particularly for high-pressure boilers, because the silica content of the water is not increased, as contrasted with the effluent from green sand zeolites. The latter are combinations of aluminum, silica and sodium, and disintegrate if subjected to water of low or high pH values. Furthermore, they cannot be regenerated by sulphuric acid. The chemical formulas representing the reactions with carbonaceous zeolites are given at the top of this page.

As in other zeolites with which

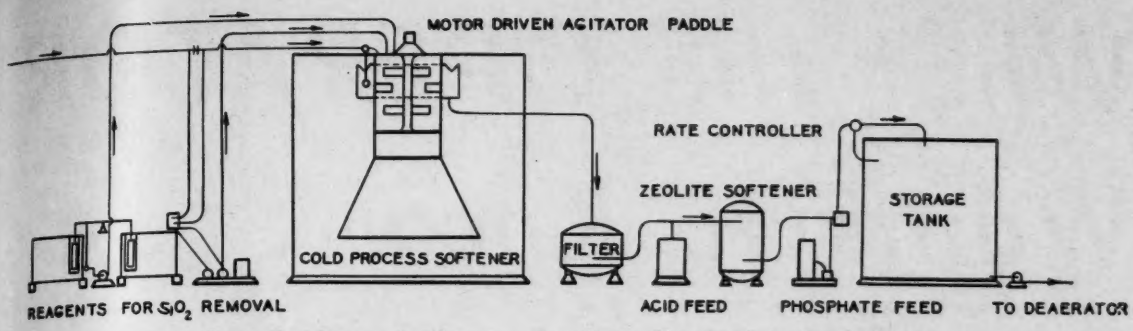

Fig. 7. Flow diagram of cold-process water softener with acid and phosphate treatment

we are familiar, one metal is exchanged for another. Thus, when zeolite is regenerated with sodium chloride, the calcium and magnesium are exchanged for the sodium, but when regenerated with sulphuric acid the exchange is for hydrogen. When water high in carbonate is passed through a zeolite bed, after acid regeneration, the carbonates are converted to carbon dioxide, thus reducing the alkalinity. For the first time in the history of water softening, reduction in alkalinity is possible by the use of a zeolite softener.

Treating Turbid Waters

The applications of zeolites depend upon the physical and chemical characteristics of the water to be treated. Turbid waters must first be clarified and coagulation becomes necessary. In addition, if the water is high in carbonates, a lime treatment should first be given, as lime costs less than acid or salt. After reduction of temporary or carbonate hardness by lime, the clarified water is treated with acid to reduce the pH value to around 7.5 and then passed through a sodium zeolite softener. The general arrangement of the equipment is shown by Fig. 7.

Use of Soda Ash

If soda ash can be purchased for less than three times the prevailing cost of salt, then it would be desirable to soften the water with lime and soda ash rather than with lime, since the amount of salt required is approximately three times as great as the soda ash requirements.

For clarified waters, as from a city water supply, and relatively high in carbonates, the combination of acid regenerated and sodium regenerated zeolite softeners is applicable. This type of softener works out nicely with water supplies from the Great Lakes. One zeolite unit having been generated with acid and the other with salt, the effluents from the two units are blended, resulting in the formation of considerable carbon dioxide, which is removed by a decarbonator. By means of such a system, the general arrangement of which is shown in Fig. 8, commercially zero hardness and any desired alkalinity can be obtained.

Other modifications of the zeolite softener, depending upon the chemical characteristics of the water, are permissible, as, for example, supplementary treatment with sulphuric acid to neutralize the alkalinity produced by a sodium zeolite softener, followed by decarbonation and deaeration. One of the latest developments is a method by which both metals and acid radicals can be totally removed from the water. This is now in development, but a number of pilot plants in operation are giving satisfactory results. The water is first passed through a zeolite softener operated on the hydrogen cycle, in which calcium, magnesium and sodium are replaced by equivalent quantities of hydrogen and, following this, the water is passed through what is termed an anion exchanger, in which the sulphuric, nitric and hydrochloric acids produced in the hydrogen cycle are absorbed. This process, therefore, produces a water which is the equivalent of distilled water, with the exception of silica. Where the silica is relatively high, other means will have to be provided for its removal.

In choosing the method to be followed for softening boiler feedwater, each case must be studied individually. Two plants using identical water supplies may with advantage utilize different methods of water conditioning, by reason of their respective capacity requirements, physical layouts, floor spaces and other specific conditions. Such problems must be analyzed carefully in order to arrive at the system which will supply water of suitable quantity and at the lowest cost for equipment and operation.

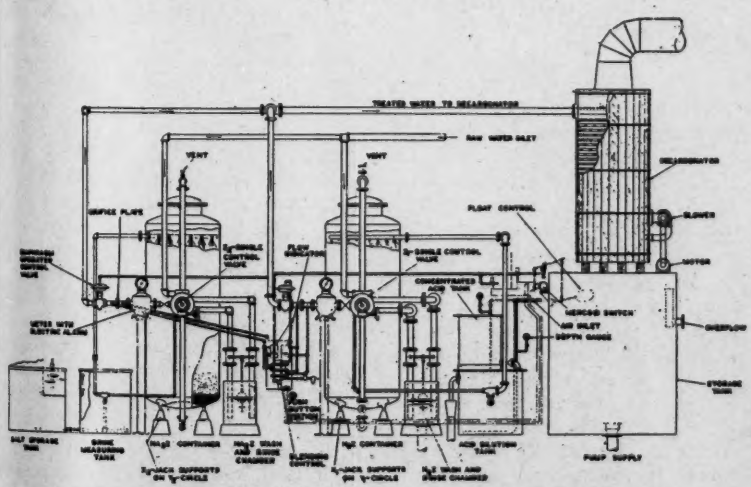

Fig. 8. Combination of acid-regenerated and sodium-regenerated softeners, with blending and safety controls and decarbonator for removal of CO_2

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What the OPERATOR Wants to Know

Part II.* A review of present day steam power plant practice from the standpoint of the operator. Slag and Ash—fuel selection as influencing operating range, birdnesting, mechanical cleaning, ash softening temperatures, slag troubles with oil fuel. Baffles—baffles of tubes, influence on draft loss and cleaning, metal and tile baffles. Spare Parts—gage glass troubles, handhole reseating, and the best spare of all, a qualified welder. Air Leakage—effect of and purpose of steel casings, features of insulation in preventing leaks, and allowable limits of excess air leakage 5 to 10 points

by Alfred Iddles, Application Engineer, The Babcock & Wilcox Co., New York, N. Y.

RECENTLY specifications were issued, calling for a slag tap job to handle coal within range of ash fusion temperatures of from 1900 to 2800 deg. F. As far as stated, the engineer expected to obtain equally good results with any of these coals. Naturally this is a condition which all of us would like to obtain but which is difficult to do with our present knowledge.

If this engineer had specified the same range of fuel with dry bottom operation, then it would have been necessary to design the boiler around the lowest fusion temperature, which would have meant a large unit, or, as has so frequently happened, the unit would have been designed for what somebody guessed was going to be the average coal. If the fusion temperature were lower, then slag difficulties very likely would occur; if the temperatures were higher, of course the unit would be entirely satisfactory if it were right for the assumed average.

Slag and Ash

The engineer might have specified the coal which was his normal supply and stated how badly he wanted to be able to burn the lower fusion coal and how much he was willing to pay for the extra size to provide for such low grade fuel. Most everyone understands that on a dry bottom job, the difficulties are likely to occur with low fusion ash and high loads; whereas with a slag tap job, the difficulties will occur with a high fusion coal and low loads.

Operating cycle or load factor on the unit has an important bearing upon which choice should be made and the buyer or operator could profitably obtain a measure of the best operating point for the unit being considered and evaluate in some degree the good and bad points in full view of his own knowledge of operating conditions. If he truly wishes a universally applicable job, then he must realize that this usually means a more costly unit than would be necessary for a more restricted set of conditions.

Of course I realize that sometimes purchasing agents are independent of operators and that apparently the purchasing agent who buys the unit seldom buys the coal. If he did and could believe his operators, then he might not be as extreme in two different directions as sometimes happens.

An operator need have no trouble with slag in convection surface. Standard practice now provides for tube spacing and cooling surface ahead of the convection surface to prevent such troubles. However, loads beyond the capacity of the unit or some exceptional fuel which the above purchasing agent may buy, may impose conditions that were not at all contemplated in the design and trouble is likely to result. Such troubles are more prevalent in these war times than ever and of course we are all interested in overloading and getting by in the best manner possible.

Mechanical Cleaning

Mechanical devices for removing slag in all forms—molten, thin, thick, dry, or what not—are available for nearly all conditions that one may meet. Naturally there are closely spaced tubes from which no blower can remove material. If one goes the limit and tries to accomplish this by water, then these tubes may be damaged. This is certainly true of alloy superheater tubes.

In general the improvement in mechanical cleaning devices hinges upon the use of large quantities of steam or air for short periods of time, utilizing the fact that quantity of force applied is frequently the determining factor and not the time over which it is applied. What this means is so-called mass blowers, either of the ordinary soot blower element type with multiple nozzles located far enough from the tubes so that these high mass flows can be obtained without resulting in tube cutting, or, retractable single nozzles of the type which project into the furnace when needed.

These may project just through the wall, or, on into the furnace opposite convection surface and may be arranged for steam, air, or

*Part I dealing with feedwater and feedwater treatment problems appeared on page 60 of the September, 1942 issue and Part III, a "look at the record" of good and bad operation in normal service as told by recording charts, will appear next month. This material was presented by the author extemporaneously before the Metropolitan Section of the A.S.M.E. and the informal style of an oral presentation has been retained.

water jets for forceful application of the fluid progressively across the unit either by lateral movement or by rotation. Most operators are familiar with this but it is well to emphasize the need for large quantities of cleaning fluid for it is the great force and commotion produced which does the good work.

Softening Temperature Not Always What the Laboratory Shows

Research in the last 10 yr. has greatly added to our knowledge of expected performance of furnaces and of heat-absorbing surfaces, so that a true knowledge of temperature entering the superheater can now be available to anyone who wishes to know. Such knowledge is certainly desirable but does not give all of the answers needed to prevent slag. Some people determine the softening or initial deformation temperature of coal ash and then specify a temperature entering the tube bank or superheater lower than this.

This is no wise an answer to the question. The commonly available information about softening temperature is obtained by the A.S.T.M. method in a reducing atmosphere. The softening temperature may be 300 or 400 deg. higher than this in some furnaces. And again one may have the ash at a temperature far below the softening temperature when it enters tube surface. Then if the velocities are high and the tube spacing is close, slag troubles will result in spite of a widespread belief to the contrary.

An operator, I would think, would prefer to have a minimum number of slag blowers and cleaning devices. Naturally he wishes a minimum of cleaning because, whether it be by mechanical means or hand, it is time-consuming and troublesome. Sometimes the specifications call for all needed cleaning devices and if this were literally interpreted, the unit might well be plastered with them. Unless the unit is a duplicate for duplicate conditions, no one knows beforehand, what the exact results are going to be.

Presumably the owner pays for the blowers and, I would feel, he would be wiser if he made provision for all that might possibly be needed, including observation and lance doors, and then installed those required by experience and closed up the doors proved by experience as unnecessary.

This certainly would end up with a lesser amount of piping, valves, and blowers to operate and maintain, and would use much less steam or air. Incidentally, he might find that the amount of cleaning needed in certain locations where slag was present was so infrequent that hand work would be much cheaper than mechanical blowing. These are all features of the slag and dirt problem which operators should be in on when units are being designed and laid out. At least this is the story I would tell any operator if he asked my opinion beforehand.

Oil Can Be Troublesome Too

We were all brought up to believe that if we could only have oil for fuel we would have no more troubles. Some of our worst slag problems today result from fuel oil. Quite likely we may not be worrying much about this in the next few months, but I do want to emphasize the fact for those who may be still using oil or those who may do so after the war, that a new and troublesome feature has developed recently. The condition was observed several years ago, but not so prevalent until about 2 yr. ago when certain fuel oil began to produce a very hard slag on boiler and superheater tubes.

Apparently this fuel oil is contaminated either at the source of the crude or more likely at the refineries where certain chemicals have been added in the refinery processes. This material analyzes largely sodium sulphate with some proportions of vanadium and nickel commonly reported in the sulphate form. This scale is so hard that in some cases it cannot be blown off.

It is like concrete to chip it off after the unit is down and usually is best removed by softening up with a fine mist of water or the equivalent in low pressure steam applied periodically so that the material is permeated by water. This will soften it so that it can be removed by bars or scrapers. Under some circumstances, extremely forceful steam jets will keep the material from collecting. This is particularly true apparently in the zone of 1600 to 1800 deg. temperature. It also collects on the low temperature end of superheaters and on economizers.

Wherever a choice is available, investigation should be made before long term contracts are entered into and such troublesome fuel eliminated. Where this choice is impossible, then the steam unit design should be viewed from the standpoint of experience with coal slag and provision made in tube spacing, velocity of gases, and other arrangements so that a minimum of damage will result.

A summary of the subject of slag indicates the following conclusions:

1. Users of fuel oil should be on the watch for troublesome slag.

2. No slag plugging of convection surface need be encountered except with loads or types of fuel not contemplated in the design.

3. Mechanical blowers adapted to the character of the slag or ash are now available in a much more useful form than was true 3 yr. ago.

The best baffle is one that doesn't exist. The next best one is made of water or steam tubes, either tangent or close enough together so that a closure can be made with studs or fins backed up by a sealing of a suitable refractory material. Where such construction is not possible, then of course baffles of the tile type applied to tubes may be necessary. They should be designed with ample support for their own weight and to withstand reasonable variations in furnace draft, in other words, puffs.

Usually baffles are installed for forcing gases over tube surface and the consideration is heat absorption. Usually draft loss is also considered and rightly so. Some other considerations not often thought of, however, are to locate the baffles so that the turns do not consume too much power and so that the flow characteristics may really result in proper distribution of gas over the heating surface. Other things being equal, the higher the gas velocity and resulting mass flow, the greater the heat absorption, but to follow this to the limit almost invariably results in trouble.

This is especially noticeable on waste heat boilers where large dust loading in the gas flow frequently results in cutting tubes or cutting clamp bolts or other structural devices installed in connection with the baffle. This has been very troublesome on some pulverized fuel jobs where attempts have been made to obtain exceptionally high mass flow. Tubes have been cut out in a few months and the moral is

that one cannot have the maximum theoretically available efficiency without running the risk of getting into practical trouble.

Small changes in the length of baffles materially affect the shape of the flow curve around the end and changes may materially affect slag deposition. Providing an enlargement of space where the turn is made, will frequently result in lower draft loss.

My principal point on this subject is to eliminate baffles wherever possible. Use metal baffles where temperatures will permit. Keep dampers in cold zones and make baffles out of tubes wherever possible. All of this is on the assumption that the operator wishes to keep out of trouble and that he can control his purchasing agent when the extra cost of this improved design is contemplated.

Spare parts is a subject about which an operator can be told little. Undoubtedly if he has his way, he has an ample supply of spare parts.

We have all learned that high-pressure boilers have more trouble with gage glasses than low-pressure ones and I am afraid some of us have discovered that the quality of available glass is worse than it was a few years ago, all of which adds to our troubles for spare glasses are of course essential. In a number of instances, however, glass breakage has been markedly decreased by shadowing the glasses to prevent drafts and by special training of mechanics for their reinstallation.

Most flat glasses involve installation technique which is frequently not available in the ordinary mechanic and many plants have found it desirable to train two or three men and depend upon them always to make the glass change. The "feel" of the situation seems to be a part of the art.

A Reseating Machine Is Desirable

Sometimes I pray for an old-fashioned mechanic who knows how to reseat a handhole plate or header seat and occasionally wish erectors were not so carefree about the quality of such seats. My suggestion is that plants which can afford to, have a reseating machine so that, when necessary, a real job of reseating can be done. It will save many a wasted hour in bringing a boiler on the line and frequently prevent unscheduled outages. Of course most manufacturers are eliminating handholes wherever possible, especially in superheaters and economizer headers, but it does not yet seem wise to eliminate handholes in water wall headers because of need for inspection and possible cleaning. These handhole fittings must be properly maintained or trouble will result.

Air Leakage

Most people are still specifying steel casings. Some tell me that they do so because of the appearance and others because they expect the casing to be tight and therefore the air leakage into the unit very low. The matter of appearance, is a matter of artistic temperament and perhaps of prejudice. To those who have the power to choose we must necessarily defer to their wishes, but with those, however, who assume that a steel casing will prevent air leakage I must disagree.

There are many well cased jobs, with all of the casing seams welded, which in no wise have low air leakage. I saw one recently where the casing was perfect except that it was open at the bottom and the air seeped in between the insulation and the setting or up through cracks in the insulation, so that the result was anything but proper. To really put a casing around the entire unit and make the casing itself air-tight is exceedingly difficult.

The best spare part that an operator can have is a qualified welder. If he has this and an assortment of tube sizes and lengths, he can take care of all of the pressure parts of a modern boiler and save time and money. Of course there are some units in which simple relatively straight tubes may be stocked for replacement or where perhaps a superheater loop might be profitably in the storeroom, but, by and large, repairs due to common difficulties, such as a bad section of tube or a soot blower cut or a spot that has been mechanically damaged, can be more easily and quickly made by welding in a section. This applies also to water wall tubes and economizer tubes.

Fig. 3. Wide spacing of tubes to minimize accumulation of ash and slag. A type of construction which is very successful in eliminating slag troubles when combined with proper heat absorption in the furnace and with proper areas and gas velocities

There are many openings, places where tubes come in or out, soot blowers and other points, where leakage can occur unless very expensive seals are made. It can be done for I know one unit where there is one point difference in excess air between the burners and the economizer outlet. But again I know another, with the same general type of casing, where there are at least 20 points difference between these two extremes.

Steel casings are sometimes used for a third purpose, that is, to act as an external armor coat against possible injury to operating personnel in case of failure of pressure parts. Usually such failures result in dislocation of tubes and severe commotion inside of the furnace or boiler setting and seldom appear on the outside.

There are, however, a few cases

m which the wall construction, including buckstays and support for insulation, was of such a nature that tube failure resulted in force applied on the outside and, in the absence of a casing, might have caused a dangerous condition to personnel had they been adjacent at the time of the failure. If a casing is to be omitted, as is frequently done nowadays, care should be taken to provide details of construction to minimize the risk from a safety standpoint.

A most important feature is to have the insulation put on the outside of the pressure parts and brickwork (where such exists) in such a way that there can be no leaking through either, horizontally; or vertically and then horizontally. This may mean at least breaking joints and well buttering them.

It usually means applying the insulation with horizontal barriers to prevent leaks; applying a sealing coat on the outside of the insulation to prevent infiltration from the outside; and then holding all this insulation tightly in place either by pressure from the casing, or, by tie bolts back to the pressure parts with reinforcing attached to these bolts and arranged to apply the pressure.

The manner in which units are supported and the location of the necessary expansion joints have a material effect upon air leakage. In general, where the casing and the unit can come and go together and as a whole, there is less chance of leakage than in the older units where part of the unit is bottom supported and part top. If the unit is small enough, of course it can be bottom supported. If not, then probably the minimum of troubles occur when it is top supported.

Usual construction today should produce a leakage of not more than 10 points in excess air and more likely 5 or 6 between the burners and the economizer outlet. More than this is not desirable because the air should really be put in at the burner and incidentally heated up through the air heater. If the excess air is much above 20 or 25 per cent, the dry gas loss becomes a worthwhile item. Several different types of unit are available with enclosures which can be made sufficiently tight so that the leakage need be no more than 5 or 6 or 7 points in excess air.

The Construction of Alinement Charts

Charts using non-parallel or curved scales. These charts are more complex than the ones using straight lines described in the first part of this article* but in many instances they provide the only means of expressing an equation in chart form. By the use of the procedure outlined, an alinement chart may be constructed for any equation which can be put into the specified form

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THE FIRST PART of this article described the construction of simple alinement charts involving only straight lines. Such charts, it was shown, are comparatively simple to make provided certain rules are adhered to.

While charts with parallel straight scales are the simplest and consequently the most commonly used, certain equations cannot be expressed by such charts since it is impossible to put them into the required form. In such cases it may be possible to use a more general form of chart with non-parallel or curved scales, such as the one shown in Fig. 3.[1] This is a more complex form of chart.

If it is desired to represent an equation with three variables—R, S, and T respectively—by an alinement chart, such a chart can be constructed if it is possible to transform the equation to the following form:

$$(3)\ (t_1 - s_1)\ r + (r_1 - t_1)\ s + (s_1 - r_1)\ t = 0$$

where

r and r_1 are functions of R only
s and s_1 are functions of S only
t and t_1 are functions of T only.

If the three curves given below are plotted on rectangular coordinates with axes X and Y and the individual points on the curves are numbered with the values of R, S, and T used to determine the respective values of x and y, an alinement chart representing the relations among these variables is thereby obtained.

The equations are:

For curve of R: $x = r_1$, $y = r$
For curve of S: $x = s_1$, $y = s$
For curve of T: $x = t_1$, $y = t$

If $t_1 - s_1 = m$, and $s_1 - r_1 = n$, equation (3) reduces to the form $mr - (m + n)\ s + nt = 0$.

If m and n are constants, the curves of R, S, and T will be straight lying parallel to the Y axis.

To construct a chart for an equation of the general form of equation (3), the procedure is similar to that outlined for the simple form of chart equation. However, because of the wide possibilities of variation of form of the general chart, less specific rules are given.

Constructing an Alinement Chart of General Form

1. The equation to be used is written down in its original form.

2. This equation is reduced to the form of equation (2), namely $(t_1 - s_1)\ r + (r_1 - t_1)\ s' + (s_1 - r_1)\ t = 0$.

(Note that if the quantities in parentheses are considered to be coefficients, the sum of the coefficients is equal to zero.)

3. Values of r_1, s_1, and t_1 are chosen, starting with the coefficient containing the greater number of variables and proceeding to the other coefficients.

4. A few values of x and y are calculated for each curve for the range in values desired for each variable, using the relations:

For curve of R: $x = r_1$, $y = r$
For curve of S: $x = s_1$, $y = s$
For curve of T: $x = t_1$, $y = t$

*Page 82 September, 1942 Issue.

[1]Figs. 1 and 2 appeared in Part I of this article in the September 1942 issue, p. 82.

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5. From an inspection of these values, suitable scales for x and for y are chosen and the tabulated values of x and y are plotted, marking each point with the corresponding value of R, S, or T. Additional points as desired are calculated or determined graphically.

EXAMPLE: (The numbers of this example correspond to the numbers of the rules for construction.)

1. Given the equation $ac^2 + 2ab + bc^2 + ac = 0$ and required to construct an alinement chart with the three variables a, b, and c, where the value of a varies from 0 to -15, b varies from 0 to 20, and c varies from -10 to $+10$.

2. By inspection and trial and error, the terms may be grouped to form the following equation:

$(c^2)\,a + (c^2 + 2a)\,b + (a)\,c = 0.$

It is evident that by using the proper factors for the various terms, the sum of the coefficients can be made equal to zero as follows:

In its present form, the sum of the coefficients is equal to

$c^2 + c^2 + 2a + a = 2c^2 + 3a.$

By inspection, the equation can be transformed to

$$(c^2)\,a + (-c^2 - 2a)\,(-b) + (2a)\,\frac{c}{2} = 0$$

in which it will be noted that the sum of the coefficients is equal to zero; viz., $c^2 - c^2 - 2a + 2a = 0$. The form of the equation $(c^2)a + (-c^2 - 2a)\,(-b) + (2a)\,\frac{c}{2} = 0$, is that of $(t_1 - s_1)\,r + (r_1 - t_1)\,s + (s_1 - r_1)\,t = 0$.

3. Comparing these two equations, by inspection we let

$a = r =$ a function of $R =$ a function of a; $a = R$

$-b = s =$ a function of $S =$ a function of b; $b = S$

$$\frac{c}{2} = t = \text{a function of } T = \text{a function of c; } c = T.$$

The coefficient of $(-b)$ contains the greater number of variables, and the portion of this coefficient which is a function of c is $-c^2$. Consequently, $c^2 = t_1$ and $-2a = r_1$. By inspection of the coefficient of $\frac{c}{2}$, the relation $s_1 = 0$ is obtained.

4. Accordingly, from rule r,

For curve of a: $x = -2a$, $y = a$

For curve of b: $x = 0$, $y = -b$

For curve of c: $x = c^2$, $y = -\frac{c}{2}$

Using these relations, the following tabulation is obtained:

a	$x = -2a$	$y = a$
0	0	0
−10	20	−10
−15	30	−15

b	$x = 0$	$y = -b$
0	0	0
10	0	−10
20	0	−20

c	$x = c^2$	$y = -\frac{c}{2}$
0	0	0
2	4	1
4	16	2
6	36	3
8	64	4
10	100	5
−2	4	−1
−4	16	−2
−6	36	−3
−8	64	−4
−10	100	−5

5. From an inspection of these values, the scales for x and y shown in Fig. 3 are chosen. The curves are plotted, and the plotted points marked with values of a, b, and c from the tabulation to obtain the completed chart of Fig. 3. Intermediate points are determined graphically. By placing a straight edge on this chart, as indicated by the dotted line, the value of the third variable may be obtained when the values of the other two are known.

By following the procedure outlined, an alinement chart may be constructed for any equation which can be put into the specified form. It is impossible to put some equations into the specified form, but even for these a modification of the variables may make a useful chart of this type possible.

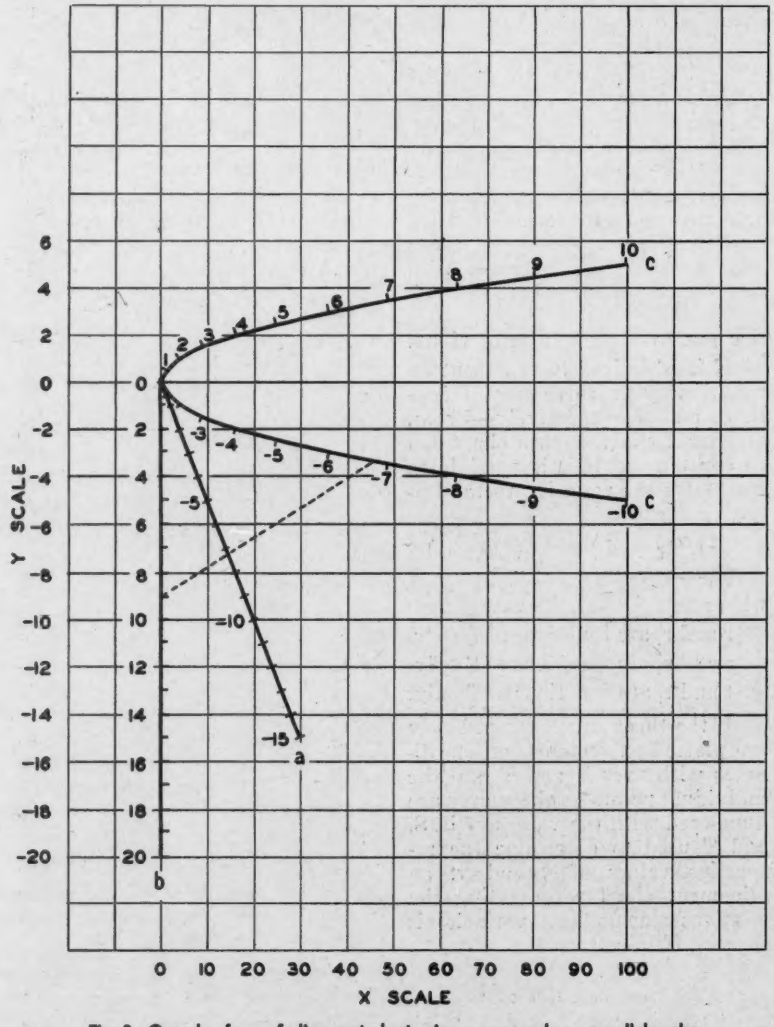

Fig. 3. Complex form of alinement chart using curves and non-parallel scales

MAINTENANCE Can Prevent Steam Turbine ACCIDENTS

By T. W. HOWARD
Contract Service Dept.
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While amazingly long turbine runs, without inspection, are on record, good practice indicates that after the first year of operation inspections should be made at regular intervals of approximately 10,000 hr. operation with complete chart and photographic records made at each overhaul period. Frozen control and relief valves are common causes of serious accidents and periodic checks of safety devices should be made on the assumption that "everything is wrong until it's proven right." Case studies of turbine accidents show that a thorough maintenance and inspection routine is the only safety guarantee to operators and equipment. Now with materials scarce, equipment working at capacity and many new operators, a fixed maintenance schedule is needed more than ever

WHILE THERE are individuals who dread medical examinations in fear of what they may disclose and even some who do not want to know if they have a serious ailment, reasonable people recognize the value of periodic checks on their physical condition. Such precautionary measures reveal complications in their early stages when they may be satisfactorily treated and corrected. The same principle applies in the operation of steam turbines.

In 1907, one of the early vertical turbines was run for a period of 2 wk. without a shutdown and among the power men of the day, that was considered a startling record. Now it is not uncommon to read of turbines that have run continuously for months at a time, and of operation without inspection or appreciable maintenance for more than a decade. These are amazing feats of continuity, but the foremost power generation men have long since recognized the wisdom of making frequent inspections of their power plant apparatus.

Inspections Every 10,000 Hr. of Operation

It was more or less standard and accepted practice 15 yr. ago to open large turbines each year, and this course is still adhered to by many conservative companies. Periodic and fairly frequent inspections are advisable even though the load factor is light, since deterioration can occur during shutdowns. In late years, there has been a tendency to extend the operating period, especially after the first inspection. A favorite program is to examine the turbine after the first year of operation, or even in less than a year, and then lengthen the operation interval to approximately 10,000 hr. between subsequent inspections. The reason for this modification is that most boiler, condenser, and other station irregularities develop during the initial operating trials and normally a condition of stability is attained after the first few months of service.

Fig. 1. Example of eroded steam turbine diaphragm partitions. This action reduces the strength of the diaphragm, changes the steam pressure distribution within the turbine, and the deteriorated partitions do not properly direct the steam, thus introducing the possibility of bucket troubles

There are still a few dissenters to the policy of frequent inspections, and with some assurance, for by exhaust hood or peep-hole inspections, operation of even very large units without disassembly and overhaul has been extended for rather remarkable periods. However, the majority of the utilities do not take such chances and many have developed a systematic and most thorough procedure for the checking and recording of wear, erosion, and gradual deterioration, so that they can quite accurately predict the life of wearing parts, accumulate replacements, and schedule repairs during the most advantageous periods.

Much credit is due to those outstanding companies that make it a practice of recording, by charts,

measurements, sketches, photographs and detailed descriptions, the exact status of all vital turbine parts at the time of each periodic overhaul. This not only aids the operator but it is of considerable value to the turbine designer, and it constitutes a definitely progressive step in power plant practice. Such records, particularly when there are a number of similar machines in the same station, enable the owner to shift rotors and fields, interchange diaphragms, bearings and other parts, so as to get the maximum return on his investment.

Thus, by the intelligent use of existing equipment, the longest and most satisfactory life may be realized from the apparatus, and the availability factor on each individual unit will probably be raised. Similarly, the erosion of steam passageways, enlargement of bearings, wearing of packings, and even the extension of casing cracks or minor defects may be progressively charted and projected to safe limits. The existence of such records assists the operating men in obtaining the guidance of the turbine designer in predicting the probable life of the parts.

Closest attention to the care and inspection of prime movers is of particularly vital importance at the present time. There are many new and relatively inexperienced men being taken into the industry, the demands on the machines are exceedingly heavy, and the possible existence of the saboteur introduces an elusive but definite hazard.

By the very nature of the service involved, public utilities, either municipally operated or privately owned, should set the highest standards in accident-prevention effort. Power plant equipment is universally designed to include every reasonable precaution, and yet from time to time serious accidents continue to occur. Runaways, wrecks, explosions, are seldom publicized as there is fear of some reflection on the builder, the installation crew, or the operators of the units in question. Yet it does no good to hide our heads in the sand particularly if there is a lesson to be learned; one that will profit us all if it is freely and impartially reviewed with the sincere aim of preventing a recurrence. We learn by our mistakes, and an open-minded and unbiased approach involving a study of certain cases on record will serve to show how important the subject of maintenance becomes.

Some "Horrible Examples" of Negligence

Control valves must be kept in good condition so leakage through them will not allow the turbine to overspeed. Not long ago this situation resulted in the complete wrecking of a turbine generator. With the control valves in poor condition and a sudden loss of excitation on the generator, the turbine started to overspeed. Valve leakage made the operating governor ineffective and as a second complication the throttle stuck open. Even efforts to close the throttle by hand failed, while the speed continued to increase. Helpless, the operators barely escaped from the turbine room before the machine flew to pieces. In this case the speed was so high and the resulting forces were so great, that all of the wheels left the shaft which was broken into three pieces; and parts of the turbine went through both the roof and the walls, damaging other equipment in the station.

Records disclose that one of the most persistent offenders involved in serious turbine accidents is inoperative safety devices, particularly relief valves that are applied to prevent the building up of excessive pressures in parts that are not designed to withstand those pressures. It seems to be all too common to install an atmospheric relief valve and then assume it will function properly thereafter.

While some sort of periodic checks are usually made on these safety devices, they are not always made with the proper critical attitude to prove definitely that the device will work so it can be relied upon in an emergency. It is not sufficient just to go through the motion of a test; it must be done conscientiously, even better, suspiciously. If we search for and expect trouble, and in spite of this the device works as it should, then the chances are it will serve properly as a safety feature when the unexpected happens.

The General Electric Co. urges its own representatives to aid in this prevention work, as is evidenced by the following from our erector's handbook:

"One definite hazard lies in the possibility of automatic safety devices becoming inoperative through negligence, commonly by the lack of an established inspection and testing routine. As serious and fatal accidents have occurred, all erection supervisors are urged to review the relief provisions when repairing, overhauling, or inspecting our turbines.

"If the machine is equipped with an automatic relief valve or a back-pressure relief valve of the automatic type, particularly where there is no supplementary blow-out diaphragm, remind the operating chief to test the valve and to determine by inspection or disassembly if necessary, and trial, that the valve will open freely.

"The above admonition in no

Fig. 2. Cracked bucket discovered on inspection. Corrosion tends to weaken the resistance of materials to fatigue

way relieves the operators of a responsibility which is theirs, but it is our gesture in a concerted and persistent effort which must be made by all concerned toward preventing loss of life as well as damage to valuable property."

These suggestions are not presented as an indictment of the operating men, but that we may all realize the vital significance of establishing an effective safeguard. It is true that certain types of accidents do involve acts of omission or commission on the part of the power house personnel; the men forget to open certain valves that should be open, or the proper starting sequence is not observed. Then we must fall back on the equipment that is provided to give us protection against such mistakes. We cannot hope to eliminate completely the human element, but we can see to it that our protective apparatus is in good shape.

Within the last 3 yr. one moderate sized turbine-generator was wrecked, and the exhaust hood was blown to pieces. One man was killed; three others were injured. This was believed to have been due to an atmospheric relief valve that failed to open when it was called upon to do so. Investigation revealed that it had not been tested for some time.

In another case a large 1800-r.p.m. turbine-generator had its exhaust hood badly shattered and the condenser connection piece nearly ruined from an inoperative atmospheric relief valve. This machine was out of service for approximately 4 mo. before repairs could be made to the castings involved.

Sometimes the Operators Are at Fault

Not long ago a small pump turbine had its upper hood blown completely off and the attendant was killed because the relief valve failed to function properly.

Within the past year, a 25-yr. old turbine overspeeded, due to leaky valves. The speed did not greatly exceed normal, nevertheless a failure occurred. Examination disclosed that a portion of one of the fractured wheels contained an old discolored crack. Evidently a fatigue fault was gradually developing but the turbine had not been overhauled or given an internal inspection for the preceding 7 yr. Who knows but that this accident might have been averted had a regular periodic examination been made?

As an example of how necessary it is to be precise in the testing of safety devices, there is the case of a small turbine which was equipped with an atmospheric relief valve and the operators thought they had actually tested it and proved that it was in good working condition. This valve was of the weighted type with the shaft extended through a stuffing box and a long lever was supposed to be keyed to the shaft. In addition, two set screws were supposed to be tight on the shaft. The weight was moved along the lever, and the position of the weight was governed by the pressure at which the valve was to release.

This turbine was started after a shutdown of several days and the operator forgot to open the stop valve in the extraction line. Before the machine even reached speed, pressures on the shell became so high a piece of the casing was blown out. Later investigation showed that while the lever moved freely up and down, the relief valve spindle key was not in place and the set screws had cut a groove around the shaft which allowed the lever to be moved without disturbing the valve at all. The valve was found to be tightly frozen with rust and it was in such a bad condition it had to be replaced.

So the admonition is to treat your turbine like the valuable piece of apparatus it is; one that, from the present day material and time standpoint, may for all practical purposes be considered irreplaceable.

SPEEDING WIRING ASSEMBLY OF PANELS

At General Electric where many thyratron resistance welder controls are being produced for the precise control of resistance welding machines on war production, an aid to the quantity production of these controls is the pasting of oil-resistant paper wiring templets to the back of the panel. This arrangement simplifies the drilling of holes in the panel and speeds up assembly by indicating exactly where all parts must go on the panel board.

Shown here is a workman assembling one of the panels; to the left is a panel as it comes from the drilling operation. All the workman has to do is fasten the many parts in their respective places and connect the wires as indicated on the templet. He can leave the panel temporarily and take up the assembly later without hesitation, or someone else can take over for him. When completed the assembly and wiring can be checked almost at a glance preparatory to test.

In addition to speeding production of this much-needed equipment, this arrangement helps simplify the maintenance job at the plant where the control is installed.

Wind-Power Plant Continues Operation

One thousand-kilowatt wind-power plant at Grandpa's Knob, Vermont, in operation since October, 1941, considered generally satisfactory by the engineers of the project. Preliminary experience points to the probability of obtaining power from the unit for at least 50 per cent of the time. Full rated output available about 25 per cent of the time

AFTER ALMOST a year of trial operation the noted wind-power electric generating plant on Grandpa's Knob, near Rutland, Vt., is considered generally satisfactory. Speaking before the Providence Engineering Society recently, Dr. John W. Wilbur of the Massachusetts Institute of Technology who is chief engineer of the project, said that the period of operation had proved the unit satisfactory structurally, mechanically and electrically.

This unit which is the first serious attempt at wind-power development in this country was first placed in operation on October 19, 1941. On that day, it was phased into the Central Vermont Public Service Corp. system and delivered energy for 2 hr. Since that time, Dr. Wilbur said, the unit had been in quite constant operation, supplying varying amounts of energy to the Central Vermont system, depending upon wind conditions. Rated at 1000 kw. preliminary experience points to the probability of obtaining energy for at least 50 per cent of the time and full rated output from the unit about 25 per cent of the time. An interesting feature of the installation is the recent provision for making motion picture records of instrument readings in the control house so that continuous and accurate data may be obtained on the performance of the unit under varying climatic conditions.

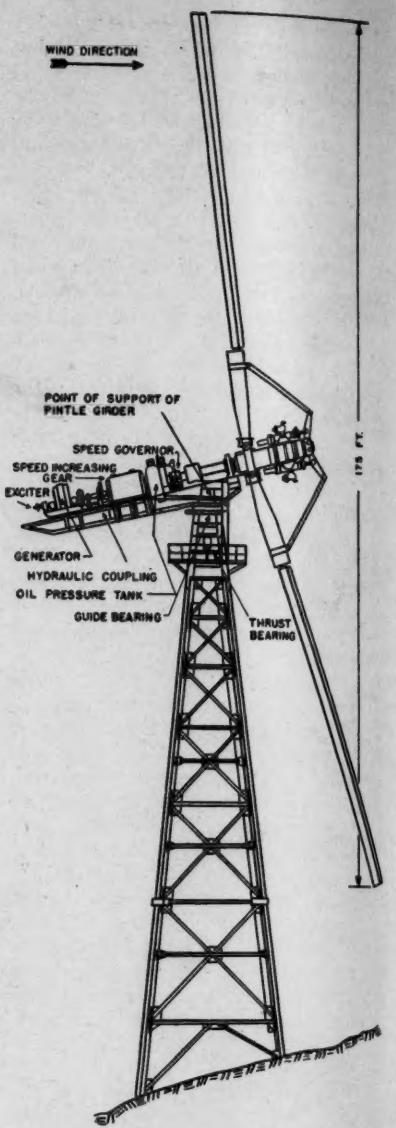
Although windmills were among the first devices man used to help him do his work, they are the last to be developed for the large scale economic generation of power. They have been used more or less continuously since the 12th Century but have undergone little change, either in principle or construction.

With the development of the airplane, however, has come increased knowledge of aerodynamics and this, coupled with developments in metallurgy and structural design made possible the Smith - Putnam wind turbine on Grandpa's Knob.

Palmer Cosslett Putnam, who invented and worked out the general design of the unit began his studies which led to this development some 8 yr. ago. At that time he came to the conclusion that all previous wind-power generating units had been built on too small a scale to be constructed at an economical unit cost and also that their unit inertia was too low for proper speed regulation. Preliminary studies verified these conclusions and after consultation with other scientists and engineers Mr. Putnam worked out the general design.

In 1939, T. S. Knight, vice-president of the General Electric Co., who had become interested in the project at the suggestion of Dr. Vannevar Bush, then of M.I.T., brought the idea to the attention of B. E. Smith, vice-president and general manager of S. Morgan Smith Co., who finally assumed financial responsibility for the project. Walter S. Wyman, president of the New England Public Service Co., also became interested and made available the power system of the Central Vermont Public Service Corp. for the experiment.

The site on Grandpa's Knob was selected because it seemed to offer the most favorable set of conditions for the operation of the unit. Purely from a wind standpoint, there are better sites than Grandpa's Knob, but in those



Details of the Grandpa's Knob plant. The entire plant, consisting of wind turbine, generator, exciter together with coupling and control equipment is balanced on the top of a 110-ft. steel tower.

locations the ice conditions are likely to be worse and the formation of ice on the turbine blades is a factor that must receive serious consideration. Grandpa's Knob has an elevation of 2000 ft. above sea level and the wind is fairly steady the year round.

Details of Design

Although the details of construction of this wind-power plant are fairly well known, for those unfamiliar with the project a brief account of them may be of interest.

As shown in the accompanying drawing, the entire unit, turbine blades, main shaft and electric generating plant, is balanced on the top of a structural steel tower 110 ft. high and 36 ft. square at the base. The base of the tower is firmly anchored into the mountain top by a steel and concrete foundation. Nearby is another steel tower on which are mounted several of various types of anemometers for measuring and recording wind velocities.

The entire plant, consisting of generator and exciter, speed-increasing gear, governor, as well as the main shaft carrying the turbine blades, rests on a heavy steel plate girder. This girder, known as the pintle girder, inclines downward toward the wind at an angle of 12.5 deg. so that the shaft is also inclined that much from the horizontal. The pintle girder is supported at one point on the tower by means of a short pintle shaft. The latter shaft has a double roller guide bearing a short distance below the point of support as shown in the drawing and a thrust bearing below that.

As is obvious from the diagram, the blades and their control mechanism overhang one side of the tower and approximately balance the generator and associated equipment on the other side. In many ways, the most spectacular feature of the wind-power plant is the two immense blades or vanes. Built of stainless steel and shaped somewhat like the wings of an airplane, they have a total wing spread of 175 ft. Each blade is 11 ft. wide and 65 ft. long. They weigh over 15,000 lb. each.

The problem of supporting these blades and working out the arrangement for varying their angle with the wind was one that involved careful consideration of many factors. The supporting structure not only had to be strong enough to carry the weight of the blades but because of the formation of ice in winter, had to be designed for that additional load as well. Possible unbalance due to unequal ice loads also had to be taken into consideration and, of course, the forces produced by winds up to 140 mi. per hr.

The arrangement used to support the blades can be seen in the photograph on page 60. Each blade is supported by its shank from the hub-post by a heavy structural steel A-frame hinge. Structural steel coning struts tie the outer ends of the A-frames to one end of the crank arms which are pivoted in the outer end of the hub. The other ends of the crank arms are connected to the hydraulic cylinder pistons that act as dashpots to take up the shock on the blades due to sudden gusts of wind.

The pitch angle of the blades can be changed through an angle of nearly 100 deg. through cranks and linkages in about the same way that the blade pitch is controlled on an S. Morgan Smith-Kaplan hydraulic turbine. When the blades are driven at the normal speed of 28.7 r.p.m., centrifugal force holds them at nearly right angles to the main shaft. In sudden gusts of wind the blades can cone downwind to an angle of 20 deg. to relieve the unit of the sudden shock and to assist the governor in controlling the speed. The speed is regulated automatically by changing the angle of the blades as the wind velocity varies. The blades, therefore, have three separate motions; first, the rotation around the axis of the main shaft; second, the change of the pitch angle around the axis of the blade itself and third, the coning of the blades with sudden changes in wind velocity.

The normal speed of the turbine is 28.7 r.p.m. This speed is increased to 600 r.p.m. by means of a herringbone gear set at the generator shaft. An American Blower hydraulic coupling is used to transfer the load to the generator shaft. The speed of the unit is controlled by a standard Woodward governor driven from the turbine shaft. Between the hydraulic coupling and the speed increasing gear is placed a friction clutch geared into a turning device fitted with a brake. The brake is used to lock the turbine in place and the turning device permits placing the rotor in any position when shutting down the unit.

The generator is a General Electric 1000-kw. 80 per cent power factor alternator, 2300 v., 60 cycles, 3-phase and excited by direct connected exciter. Since the whole top of the unit rotates on the tower the electrical output of the generator passes through a set of slip-rings on a hollow slip-ring post below the pintle shaft. From the slip-ring the cables pass down through the tower to a transformer bank where the voltage is stepped up to 44,000 v. to tie in with the Central Vermont Public Service system.

Designed for Automatic Operation

The plant is completely automatic in its operation. Starting and stopping is brought about entirely by the wind velocity, the unit going into service when the wind reaches a velocity of 18 mi. per hr. and cutting off at wind velocities over 60 mi. per hr.

The entire structure aloft, including the blades, the pintle girder and all of the equipment mounted thereon, weighs approximately 230 tons and is swung with the rotating blades always on the downwind side of the tower to any point of the compass, in accordance with the wind direction by the following automatic means:

A pilot vane mounted on the roof of the generator house actuates a Vickers control valve, which in turn operates a Waterbury oil pressure motor. The vane and control valve are so constructed that the unit will only respond to general shifts in wind direction and not to small momentary variations. The Waterbury motor drives through a gear train mounted on the pintle girder a small vertical pinion which in turn engages a bull gear secured to the tower top. Thus the entire unit aloft is revolved about the vertical axis of the tower.

The feature which distinguishes this wind-power generating plant from those previously tried, aside from its many minor points of interest, is its high moment of inertia. This is several times that of the average hydroelectric turbine. This high moment of inertia tends to even out the effect of irregularities in wind velocity, i.e., it keeps the rotor moving at times when the wind drops off and tends to prevent the sudden increase in speed due to sudden gusts. This is specially important when units of this kind operate in parallel with other steam-driven or hydraulic power units, since fluctuations in speed would tend to pull the units out of synchronism.

Thus far, according to Dr. Wilbur, 54 mi. per hr. is the maximum wind velocity at which the plant has been operated. At that velocity, he said, better regulation was obtained than at lower velocities. This initial unit was purposely overdesigned.

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In the operation of large hotel power plants one of the most difficult problems is to secure economy in the use of heat. The suggestions given here are the results of the author's experience as a consulting engineer over a long period of years. In this article, the first of several to be published on hotel plants, the author explains how it is possible to reduce and check the amount of steam or hot water used for the heating system in a modern hotel

Heat Economy and Comfort in Hotels

By Paul L. Geiringer, Licensed Professional Engineer, Newtonville, Mass.

HEATING a large hotel is somewhat different from the heating of an ordinary office building of equal size. The heat demands in these buildings are completely different both in time of need and quantity required. The office building requires most of its heat during the morning and is usually operated only half of the time while a hotel is much more sensitive to temperature fluctuations within its rooms than the office building.

In a hotel the guest wants a uniform temperature and is desirous of having this temperature level adapted to his personal requirements, a demand which is almost impossible to fulfill. One man wants his room heated in the morning up to 75 deg. F., another feels quite comfortable if only 65 deg. F. is reached. To meet all these demands in a hotel which has no controls for the individual rooms is rather hard for the hotel engineer, in fact impossible. After long negotiations with the managements of various hotels we have established the rule that standard temperatures for the heating have to be kept throughout the whole house, and that guests requiring especially warm rooms should be located in a few rooms which have been kept at a higher level during the whole heating period. Sometimes these guests have to be satisfied by additional electric heaters, the installation of which has proven to be much more economical than to disturb the general set up of the house. The maintaining of the standard temperatures eliminated all friction between the engineering staff of the house and the management and provided the means to check the heating of the house and to judge whether or not complaints from some guests are justified.

Before starting to introduce these standards it has been necessary to be sure that the heating system throughout the whole house works uniformly. This is the hardest task, and the achieving of savings depends to a large extent upon the degree of uniformity obtained in this regulation. In carrying out this preliminary work it is necessary to check all main risers of the system and every group of radiators and to find out the lowest steam pressure which is required to start them and to heat up the room. Faults can be found in nearly every steam heating plant and extensive work and enormous zeal are required to eradicate all the deficiencies. With a steam pressure which overcomes all differences, it is certainly possible to start the heating system and all its radiators at the same time. But this is not the aim for which we are striving. We are desirous of reducing the average steam pressure in the boiler house and providing means for reducing the quantity of steam sent to the radiators. We would be compelled otherwise to heat with the same steam pressure whether the temperature is 40 deg. F. or zero. In order to regulate and to control a complete heating system economically it must be made possible by the variation of the steam pressure at some central point.

Two ways of accomplishing this are available. One is to adjust the traps, the level and the size of the pipe lines and their valves to the particular requirements of the individual radiators. The other is to accept the deficiency of the system as something unchangeable and to equalize the differences by means of orifices. This is of course the inferior method and will not provide as good results as the thorough elimination of all faults.

In order to cut expenses a combination of these methods will be advisable in most cases. The worst defects should be eliminated completely and smaller pressure differences can be equalized by orifices. In the changes which have to be carried out, separate valves should be installed for each section of the building—if not already existing—using a type which enables throttling the steam pressure, so that different parts of the house can be operated at the same time with different pressures.

Modulating Heating System Prevents Losses

Many hotel engineers who think that their heating system is really equalized have not even tried to operate with different pressures at varying outside temperatures. Maintaining a steam pressure that is too high or hot water temperature above requirements means a continuous loss of heat. A heating system originally designed as a modulating system prevents these losses automatically.

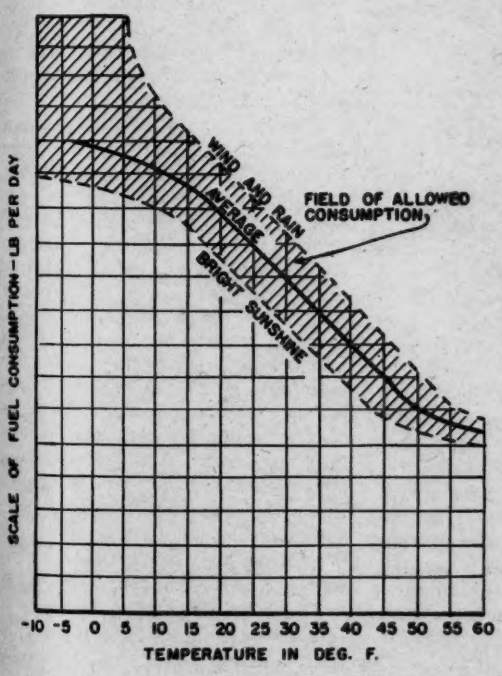
With the heating system properly equalized, the next task is the

selection of the standard rooms. Their temperature has to be reported by means of electric thermometers to the boiler house. The suitable selection of these rooms is important for the success of our scheme. First of all it is necessary to make certain that the radiators of these sample rooms are neither too small nor too large, that the rooms are not too exposed or too protected so that they represent in fact good average rooms, the temperature of which may be used as a standard for the temperature level to be maintained in the adjacent rooms and situated on the same side of the house. On a side length of 45 to 60 windows per floor, two check rooms are usually sufficient. Every second or even only every third floor requires the establishment of such check or standard rooms. In these rooms the windows should not remain open unreasonably long during the day. I have arranged that the maid servants give special attention to these rooms.

Having selected the standard rooms and connected the electric thermometers with indicators in the boiler house, the control of the heating system can be started. Such a control system will maintain a certain temperature level during most of the time of the day and a lower one during the night. During day time usually from 7 a. m. to 9 p. m. the temperature in the standard rooms should not exceed 71-72 deg. F. if the outside temperature is below 32 deg. and not be more than 70 if the outside temperature is higher. Some hotels arrange to have the room temperature lowered by 5-7 deg. from 10 a. m. to 12 noon. After 9 p. m. the temperature can be reduced to reach approximately 65 deg. F. at midnight and to be diminished to about 60 deg. F. until morning at approximately 6 a. m. when it again starts to rise in order to reach the normal day temperature level at 7 or 7:30 a. m. The room temperatures during especially cold nights, below 30 deg. F., often have been increased by 2-4 deg. F. Reducing the temperature can be achieved easily by reducing the steam pressure at approximately 9 p. m. and stopping the heating completely between 11 p. m. and 1 a. m. almost every night. It is usually more economical to cease heating completely every night than to maintain boiler pressure continuously. On very cold days only, or bitter cold nights, the maintaining of fire in the boiler during the night is unavoidable to satisfy the guests. The control of the heating on those nights is of major importance and requires as much attention and care as during the day.

Method of Control

In a normal heating system not primarily designed for exact modulation of the pressure, the range of variation of the pressure even in an equalized heating system would not be sufficient. A further means of control may be gained by varying the heating time and in this way reducing the amount of steam sent to the individual radiators. Combining the regulation of the pressure with the reduction of the on period of the steam according to the outside temperature is sufficient to maintain the desired temperature in the standard rooms.


SCALE OF FUEL CONSUMPTION - LB PER DAY
WIND AND RAIN
AVERAGE
BRIGHT SUNSHINE
FIELD OF ALLOWED CONSUMPTION
-10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60
TEMPERATURE IN DEG. F.

Typical chart for fuel allowance

This regulation can be done manually, but it is performed much more economically by some modern devices which are on the market. These devices which can be combined with the outside temperature or with the temperature of one or several standard rooms are of value only when the whole heating system is equalized, otherwise they cannot serve their purpose.

For recording the temperature of the standard rooms and noting the most important boiler house operating data, records should be kept. These data should be recorded every hour or in smaller houses every 2 hr. The report must also contain the mean temperature of the day as recorded by the local weather bureau and the fuel consumption. The report forms have to be worked out for each house individually according to the specific requirements of each hotel.

For larger hotels it is also advisable to be in permanent touch with the office of the weather bureau and to secure in the morning information on the prevailing temperature, the temperature to be expected and the mean temperature of the preceding day. All these data should be compared with the hotel readings and should be recorded. To a certain mean outside temperature during the day time (usually the night can be excluded if not particularly cold) a certain allowance in fuel consumption may be estimated. This figure has to be increased or decreased within limits of 10-15 per cent, depending upon whether wind, rain or sunshine prevailed on the particular day.

The figures for the allowed fuel consumption based on the outside temperature can be tabulated or charted. They form a curve which at the center approaches a straight line while the ends of the curve bend. The fuel consumption on warmer days cannot be reduced proportionately, the consumption on very cold days is lower than corresponding to the outside temperature. If together with a cold spell, a strong north wind is blowing the fuel consumption might be increased out of any proportion. It is rather hard to keep a check on the consumption on these days. (From my experience I can say that I never have been able to keep the fuel consumption in absolute proportion to the so called degree day.) Such a chart, designed after

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practical experience, is shown herewith. The designing of such a curve is important for every engineer entrusted with the supervision of the building. It is a valuable device with which to keep a close check on the fuel consumption during the winter.

These general rules have to be applied and adapted to the different heating systems installed in hotels. Usually steam heating systems, equipped with vacuum pumps, will be found. Those designed with modulated control, so that the steam pressure can be varied within wide limits, are of course the most economical and modern. Although the same ideas with somewhat decreased efficiency can be carried out in every steam heating system, the same applies also to hot water heating systems of all types and the same care and sometimes even harder work is required to establish uniform heating in these plants.

One pipe steam heating systems, as well as one pipe hot water systems are very unsatisfactory, their control though rather difficult is not impossible; the reduction of steam pressure, or water temperature is usually possible only within very small limits and the only control feasible is by regulating the on and off periods of the heat. Sometimes it requires considerable alteration in the installation before even this simple regulation can be introduced.

Larger plants should never be designed as one pipe systems and it seems to me that it is important in order to be in a position to achieve savings in these plants to change over their layout completely. In forced hot water heating systems it is rather important to control the amount of water circulated through the whole pipe system. I have observed a tendency to install hot water heating systems with pumps of a size that even on coldest days a temperature drop of not more than 20 deg. F. can be maintained. In warmer weather this temperature difference is reduced to only 10 or 12 deg. This creates an unnecessarily large water circulation and the heat loss through the insulated or uninsulated pipes is increased.

The overall efficiency of the hot water system can be increased by throttling the water circulation on warmer and colder days as far as possible, but of course not below the limit which is set by the required even heat distribution to all radiators. Generally it may be said: It is not important—as often assumed—to maintain a small temperature difference within the radiators and certainly on warmer days the ample size of the radiators will permit reducing the mean temperature, by increasing the difference between flow and return. The reduction of the water circulation in accordance with an increased outside temperature is a means of achieving savings similar to the reduction of pressure in a steam heating system, and this possibility should not be neglected.

This method of effecting savings in a hotel heating system requires some investments which are repaid many-fold in the course of the following years. These costs include the expense of a detailed survey to find out all the deficiencies of the heating system; the elimination of the defects of the plant to obtain uniformity, requiring the work of a few pipe fitters, depending upon the size of the plant for several weeks; the installation of electric distant thermometers in the boiler house and in the standard rooms; and the installation of a regulator which automatically reduces the heating time in accordance with the outside temperature. All these investments are relatively small compared to the savings which can be expected.

The results obtained by carefully carrying out the ideas outlined here may be estimated at a saving in fuel of 15-25 per cent and often reach even higher figures.

COAL INDUSTRY LOOKS AHEAD

By A. W. Thorson

In 1933, a representative group of coal producers decided to turn, as most industries have done, to research; starting on a big job that needed doing badly, but that no one company felt justified in tackling on a broad basis. Bituminous Coal Research, Inc., was formed and it went to work.

Funds were raised from coal producers and coal carriers, and Battelle Memorial Institute, at Columbus, Ohio, was selected as the laboratory. A program was organized to apply present knowledge and current new ideas to improved domestic and industrial combustion equipment. The best mining and preparation goes for naught if the product is improperly consumed.

In addition to its contribution to the Battelle program, the National Coal Association, through Bituminous Coal Research, Inc., is contributing to the Coal Research Laboratory at Carnegie Institute of Technology.

Plastics, synthetic rubber, and others are expected to require hundreds of thousands of tons of raw materials annually. Practically the only sources of such quantity supply are coal, petroleum, and possibly alcohol from farm products.

Benzenem, for example, is a coke oven by-product used as a bulk chemical for many years. Much of our huge synthetic rubber program depends on it. The Buna type rubber is made by combining the two chemicals, butadiene and styrene. Styrene is now made from benzene and butadiene possibly will be in the future. Nylon and phenol plastics are dependent on benzene.

Last year according to statistics the coal industry used, for dust treating, 60,000,000 gal. of oil. This industry's oil bill was about $5,000,000. Why not make a dust proofing agent from our own coal? Tars have been used, but as such were not completely satisfactory, nor generally available in mining districts.

The hydrogenation or liquefaction of coal is not a commercial process because of low cost petroleum in this country. Partial hydrogenation, however, yields the light oils, benzene, toluene, etc., and also much larger quantities of phenolic compounds for plastics than can be obtained from the coke oven.

Aluminum and magnesium production has multiplied with the war. Experts predict that the post war demand for these light metals will be much greater than at any previous time. Carbon electrodes are used in the process of refining, most of which come from petroleum and pitch coke because of the low ash content. Low-ash carbon has been made in the laboratory from coal by dissolving it in tetralin, derived from coke oven products, filtering the ash and coal portion resistant to attack, and boiling off the solvent. In the laboratory the Pittsburgh seam coal has been so converted, yielding 70 per cent of original weight with an ash content of 0.0 to 0.5 per cent.

These projects cited are only a few of the many that need further research.

RADIAL DIESELS

What would you think about a Diesel engine generating unit that was only 38 in. long, overall, that developed 750 hp. at 1400 r.p.m., and that weighed, complete with generator and all accessories, only 10,500 lb.? Sounds fantastic, doesn't it? Yet, this engine was built and, as described here by Professor Vincent, ran so smoothly that a nickel standing on edge on the rounded surface of the generator remained standing for a period of 24 hr. while the engine ran at full speed. This article is based on an address delivered by Professor Vincent before the Midwest Power Conference in Chicago, Ill., last April

By E. T. Vincent,

Professor of Mechanical Engineering, University of Michigan, Ann Arbor, Michigan

DESPITE the fact that it has been used for many years in aircraft, the radial type of engine has had practically no application in other fields. The radial engine, nevertheless, has many advantages over other types of engines and, if properly designed, has much to offer in the field of stationary power service.

Figure 1 is a section through a radial Diesel engine. This drawing shows that with the radial design there are just two main bearings, a thrust bearing and a single crank with a number of cylinders arranged around it in one plane. The general construction of all radial engines is pretty much the same, and this diagram should be kept in mind throughout this discussion. Such engines are also produced in a water-cooled version—an example being the B.M.W. German radial design based on the Pratt and Whitney engine in which a number of radiators are placed between each of the cylinders, so that the water cooling surface is practically integral with the frontal area of the machine.

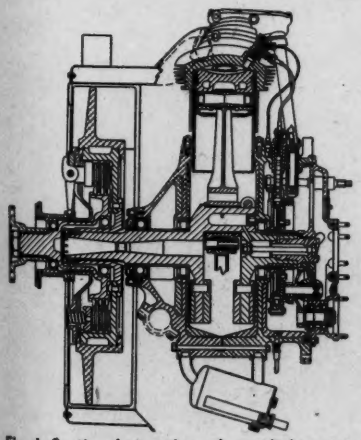

Fig. 1. Sectional view through a radial engine

The reason for the existence of the air-cooled aircraft type of engine is that it is of particularly light weight, it is easy to cool in place, and has the particular advantage that it is relatively free from torsional vibration. Those familiar with the operation of the large in-line type of engine know that the torsional vibration period problem can limit seriously the speed range. The radial engine is not so critical in this respect and that is a very important factor in any modern power plant.

It is not the intention here to dwell too long on the aircraft engine. It is the author's belief that there is quite a future for the radial type of Diesel engine in the stationary power plant field. It is not an aircraft engine alone. It has some attractive features, compared with any type of in-line engine, and the industry is missing an opportunity in not bringing this type of engine forward to the extent that it should.

Figure 2 shows a radial engine direct coupled to a generator. The generator provides the support to the base for both the engine and generator providing a complete self-contained unit. The design is one brought out by Continental Motors of Detroit, and represents a 2-cycle radial Diesel engine of quite light weight, built for the United States Navy.

It is to this type of plant that the rest of this discussion applies, not necessarily to this particular engine, but to the type in general as represented by this compact unit.

The special fields of application that this engine is suitable for is any field where relatively small space is available; undoubtedly there are many applications where space is quite a deciding

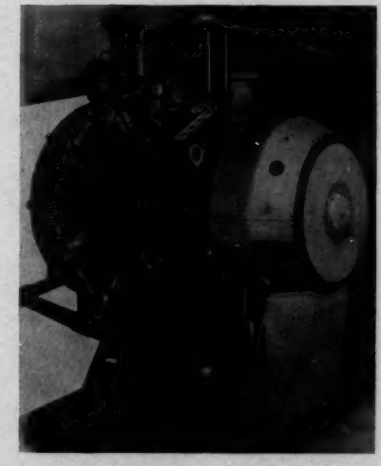

Fig. 2. Radial Diesel engine direct coupled to generator. Note that the engine hangs on the generator

factor. The above engine is only 38 in. long, is rated at about 600 hp. and it is also of light weight. Obviously a radial type engine is the type in which the lightest weight possible is achieved. This particular weight per horsepower can be achieved without using particularly light-weight parts. In the aircraft type of engine, light weight is achieved by machining the parts all over, and after finish-grinding they are finish-pol-

Fig. 3. Showing method of mounting the engine-generator unit directly on the regular engine room floor

ished to remove all surface imperfections, permitting the use of stresses of 40,000 to 50,000 psi., while in some of the reduction gears for aircraft engines surface stresses as high as 200,000 psi. or more are used, resulting in the lightest weight engine. Such stresses are not inherent in the radial design. It is still possible to forge connecting rods, crankshafts, etc., and not have to machine and polish them all over. In other words, stresses are reduced to permit of some surface imperfections without failure. This results in some increase in weight, but even so, the resultant engine will compare very favorably with any other type.

One other factor of importance in the radial engine is the fact that no elaborate foundations are necessary. Figure 3 shows the foundation for a radial Diesel engine. This particular installation was made on an ordinary power plant floor, with no foundation to firm ground. Under this, there was about an 8-in. floor of the ordinary type that is installed in a power plant covering the condensers and piping and all the gadgets that go with a steam engine that happen to be alongside. A concrete sill was made to prevent the engine from moving around the room, and some springs placed within. A piece of flat plate, on which were welded the fuel and oil tanks, was placed on the springs and the radial engine fitted thereto. The complete unit is shown in Fig. 4. The natural period of vibration of this particular installation was at 60 r.p.m. The only time that this particular assembly vibrated was in starting when the speed reached about 60 r.p.m., after which it settled down and was quite smooth for the rest of the operating range. The possibility of using such a simple flexible mounting presents a decided advantage in relieving the building of all vibrations. In addition the costs of installing such an engine are quite low, compared with any other type.

One further advantage that is associated with this type of engine is the fact that all parts from which it is built are quite light. It is not necessary to have cranes, blocks and tackle, etc., to handle the job. On the particular engine illustrated almost every part could be handled by a single man. The only part that was heavy and required some help was the crankcase. The crankcase was divided into two parts which weighed about 200 lb. each. These were the heaviest pieces in the whole engine. This can prove to be a distinct advantage for this particular type of design when the engine is to be used somewhere out in the wilds far from the usual facilities.

The radial design is a very well balanced design, and, according to the usual method of calculation, can be proved to be balanced by the use of two counterweights. But actually, a complete analysis of any radial engine as built will reveal that it is not 100 per cent balanced in the ordinary design. Two counterweights are all that are necessary if all the connecting rods meet at a point, but in actual practice they do not. Additional factors also enter into the problem. A complete analysis of the actual case made by Prof. A. J. Meyer of Kentucky University revealed that there is a secondary unbalance running at twice engine speed. In the engine under discussion, however, these secondary forces were also balanced out. The result of this type of balancing is shown in Fig. 5 which shows the same engine on the test stand. It will be observed that the tachometer indicates that the engine is running at almost 1200 r.p.m. and it will be noted that a nickel

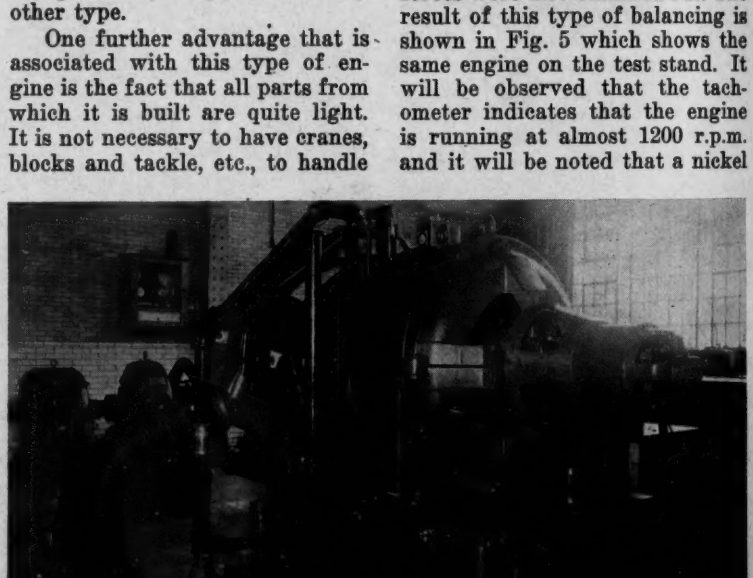

Fig. 4. Complete power unit mounted on the foundation shown in Fig. 3

Fig. 5. Showing the high degree of balance attained. Note pencil and nickel standing on edge on the rounded surface of the generator in upper right. These stood there for a period of 24 hr. while the engine ran at full speed

and a pencil are standing on the round surface of the generator. They stood there for 24 hr. without falling over, and any of the Navy inspectors who witnessed the test will confirm that. This provides an idea of the type of balance that can be secured in a radial type engine.

Torsional vibration was mentioned previously. The radial type of engine has a natural period of torsional vibration. That torsional period, for the engine shown, happened to be at 535 r.p.m., according to calculations, but the damping in the engine, due to a large number of pistons coupled to a single crank pin plus such other factors as existed, happened to be so good that with the instruments available the period could not be checked. However, at the calculated critical period there was a very slight trace of vibration.

As with everything else in this world, it is impossible to get something for nothing; so some disadvantages must be accepted with the foregoing advantages. At the present time the greatest disadvantage, perhaps, is the fact that trained personnel who can handle such engines in the power plant field are not available. The engine is different and thus time must be allowed for training the staff and getting its members used to handling it, with the result that for some time difficulties may be encountered in maintenance.

Another disadvantage of this design is probably a limitation on power output. While there are radial engines of from 2000 to 3000 hp. for aircraft work for the particular field of power generation under discussion and particularly for those installations with light weight for ease of shifting from one place to another, putting in cramped quarters, etc., it is considered that about 1000 hp. is about the upper limit for a single bank. Of course a double-bank engine would be possible, giving 2000 hp., but 1000 hp. per bank at moderate speed is about the highest that can be expected at the present time if all the parts are to be easily handled.

Another factor of considerable importance is the fact that the radial design does not conform to certain accepted standards. A large number of engineers have certain ideas in mind of what an engine ought to be, and the radial design does not fit this requirement so some difficulty in selling this type is to be expected. Hence sales resistance is another factor which must be grouped with the disadvantages since immediately a "radial" engine is mentioned the prospective customer thinks of aircraft. "Well, we don't want any aircraft engine in our place that won't last."

The Army tank has proved a number of interesting things on that angle—in the tank design it was definitely proved that there isn't any automotive engine in existence that will stand up inside of a tank. But the air-cooled aircraft engine, of a fraction of the weight of the liquid-cooled automotive engine has stood up remarkably well. So our preconceived ideas are sometimes rather definite handicaps to us.

There are one or two other peculiarities about the radial type engine that should be mentioned.

If the paths of the crank pin and knuckle pins for various positions of the connecting rods are compared, it will be seen that each piston motion is different, with the result that if the master cylinder is used as a standard for comparison, the top and bottom dead centers are not uniformly spaced either angularly or at equal distance from the center of rotation. Also, the intake and exhaust valves open and close at varying piston positions for the different cylinders.

Furthermore, the compression ratio in the Diesel type of engine varies considerably in the different cylinders due to this change of piston motion. In a gasoline engine these variations are not so great because the clearance volume is much larger, but in a typical radial engine the compression ratio varies from about 13.8 to about 14.6. These variations assume that the regular form of ring-type cam used in the aircraft radial is employed, with which one cam ring with a number of lobes has to rotate and operate all the valves in turn.

Now there are various ways of eliminating some of these differences. Instead of putting the knuckle pins at the same radius from the center, this radial distance can be varied. The distance from the center of the rotation of the pad on the crankcase, to which the cylinder is bolted, can also be varied.

With regard to costs of manufacture, it can be stated that providing such engines are designed to employ reasonable stresses, eliminating the need to machine parts all over, the costs are quite comparable with more conventional engines. What we have in the radial is a large number of small parts that can go over a production line much easier than the few large parts that have to go into an in-line engine, permitting the employment of mass production. It will be found that some of the smaller aircraft engines that are machined all over only cost somewhere around

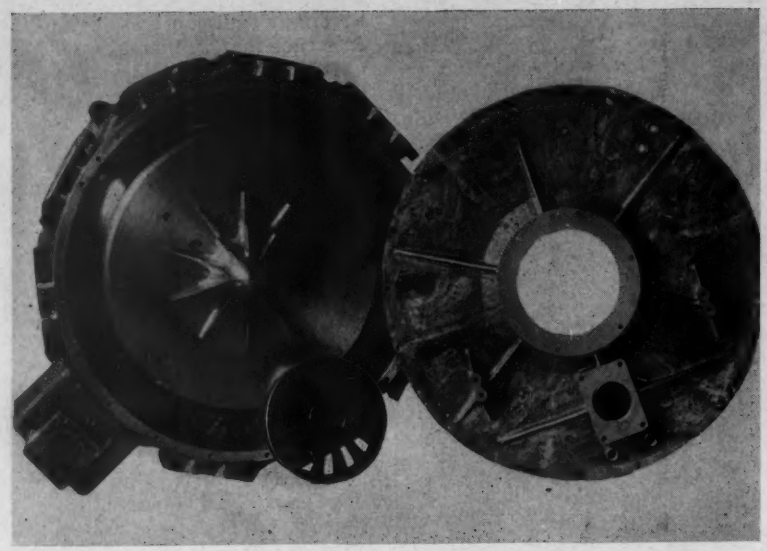

Fig. 6. Details of the centrifugal scavenger blower

$7 to $10 per hp. employing as materials of construction expensive alloy steels and aluminum.

Another problem that is presented in this type of liquid-cooled engine is that of cooling. Cylinders are at all angles, and the cooling circuit has to be watched carefully, to prevent air pockets in the castings that will cause a lot of trouble. Providing the passages inside the engine are arranged to eliminate air locks, no trouble with the efficient cooling of the engine should be encountered.

There are one or two things about the engine shown in Fig. 2 that might be of interest. The engine developed 550 hp. at 1200 r.p.m., subsequently, the rating was stepped up to 650 hp. with a full out maximum power of 750 hp. at 1400 r.p.m. The engine, complete with all attached accessories necessary for operation, weighed 3900 lb., a little over 7 lb. per hp. at the low rating. This was achieved with all major parts in iron and steel, and with no light weight materials. With oil and water coolers, of a capacity sufficient for continuous full power output, the weight came to 4500 lb., while the generator, to which it was coupled, weighed 5000 lb. So the total of the engine and generator including coolers and all other accessories was about 10,500 lb., which is quite a low weight for a power plant of this power.

In the course of the development of this unit, the large leading electrical manufacturers in this country said that a generator of the weight desired was not practicable and required about 10,000 to 12,000 lb., which appeared ridiculous when coupled to an engine a little over 3000 lb. Eventually, on approaching the Elliott Co. and convincing them that the engine weight was practicable, they agreed to reduce the generator weight to about 5000 lb. and still maintain an efficiency of 92.5 per cent.

Another point illustrating our prejudices was that the large electrical manufacturers stated that it was impossible to hang an engine onto a generator—"that was ridiculous." Their frame would never stand up, incidentally the frame was 2 in. of steel while the engine frame was ½ in. of aluminum. The Elliott Co. agreed to this arrangement and the frame to which the engine was eventually bolted was only ½-in. thick, and the engine has not fallen off yet.

A centrifugal scavenge blower of the type shown in Fig. 6 was employed; this type has the characteristic that the pressure varies as the square of the speed, so with a relatively low pressure at 1200 r.p.m. the pressure at idling speed may be very low and it has been stated to be insufficient to operate a 2-cycle engine.

This particular unit, without a flywheel, would run at no load at about 250 r.p.m. from a full speed of 1200. At the idling speed of 250 there was about 0.20 in. of Hg scavenge pressure, and the engine operated quite satisfactorily. On starting the engine, of course, a much lower pressure still existed. The scavenge pressure was so low that it could not be measured with a U-tube manometer, but according to calculations it should have been about 0.02 in. of Hg; yet a start was made readily. With speeds as low as about 450 r.p.m., full torque could be carried. Therefore this type of scavenge blower, which is eminently suited to a radial design because it bolts right on the back of the crankcase, proved to be quite successful.

These remarks cover the major points of this sample radial type of oil engine suitable for a power plant and illustrates some of the advantages to be gained by its use. It is hoped that the information given here may induce some concern to carry on with the development of this type of power plant.

The author wishes to thank both the U. S. Navy and Continental Motors Corp. of Detroit for permission to use the data presented in this paper.

ARTIFICIAL DAYLIGHT KEEPS BRITAIN GOING

FOR THE LAST 12 mo. of war the industries of Britain have used 62 per cent more electricity than in the last year of peace.

This striking rise in the electricity supplied to British industry as it expands is only one measure of the war service rendered by the country's electrical industry. They have speeded up production through the National Industrial Electric Lighting Service which gives expert advice on factory lighting through a large panel of lighting consultants throughout the country. The work of the panel is of special usefulness to those factories which are always artificially lit because of the total blackout; and here fluorescent lighting has been developed to give the workers something near to the daylight which they lack.

During the air raids the electrical industry improvised with rapid ingenuity, turning its washboilers into tea urns and soup warmers; whipping out, through the British Electrical Development Association, radiators suitable for shelters packed with people; mobilizing electric boiling rings for the blitzed streets.

They are sending into thousands of factory canteens and the British Restaurants of the Ministry of Food a steady flow of the equipment needed for communal catering and cooking.

The PRACTICAL ENGINEER and ELECTRICIAN

RICHARD H. MORRIS, EDITOR

As Uncle Sam Suggests An Editorial Change So— Off to the Wars

IT IS with a heavy heart that I sit down to fill this column for the last time, conscious that, through rumblings from European and Asiatic battlefronts, the "duration plus six months" has an indefinite ring which hinders future planning.

During normal times it is easy to forget that what we have, and what we are, are partially due to individual effort and partially to the economic systems under which we live. For the opportunity provided we all owe a debt to society—a debt which falls due when the Nation is endangered and which must be paid if the heritage of freedom and opportunity for which past generations fought and died is to be handed down to posterity. Young men must pay that debt by a grim gamble with death—older men with infinitely more precious stakes—the lives and future of their families.

Measured in worldly goods my debt is small but measured in experience and satisfaction it is huge. As a soldier in the last war, as an engineer ashore and at sea, and, of recent years as an editor, I have seen a good bit of the world and have had the things I want most. The good has been generously sprinkled with the bad but in retrospect it all fits into a mosaic which I cherish and would not want changed.

No part of that mosaic stands out brighter than the periods I have edited the P.E.&E. section. Any editor's acquaintance must be wide and his correspondence heavy, but the more personal basis of editing the P.E.&E. has developed an almost unbelievable amount of correspondence from hundreds of engineers in all parts of the country. This is an unending source of satisfaction to the editor which is equalled only by the knowledge that the P.E.&E. section will be carried on by Andy Kramer who originated it and enjoys it quite as much as I do.

Of necessity I must take this means of saying farewell with best wishes to all and a deep sense of gratitude to the many who have helped to make my job a pleasant one.

Richard H. Morris
Captain, Army Air Forces

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A Section of Power Plant Engineering Devoted to
PLANT OPERATION AND MAINTENANCE

Technical Publishing Company
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The Why, When, What, Where and How of FLOW METER INSTALLATION

Part I. Why, When and Where Flow Meters and Instruments are needed in the modern plant and how they can be made to further the war effort

By W. C. BENNETT

Cochrane Corp.

The control and instrument board is the nerve center of industry

WAR CALLS for increased production with existing facilities and with the maximum fuel economy. Thrifty plant housekeeping is now important mainly because it will enable us to do more with less. Fuel, always an important sinew of the war musculature, is now the most critical material in sections remote from its origin.

Fuel conservation will help win the war—flow meters will help save fuel. They will do that directly in the boiler room by obtaining combustion efficiency; they will save fuel indirectly in the turbine room by guiding generating efficiency and in the manufacturing departments by securing processing efficiency.

Flow meters won't do any of these things by themselves, but they enable you to do them. Measurement of flow offers important possibilities for waste reductions and improvements in processes. On guard every minute, flow meters warn you of the slow trend as well as the peak condition. They warn —you can then act.

In operating a boiler, a turbine, or a piece of process apparatus, you deal with temperature, pressure, level and flow. Measurements of temperature, pressure and level insure uniformity, but do not usually reveal waste—they are qualitative measurements and they tell to what degree. Flow measurement is a quantitative measurement—it tells how much.

Thus flow measurement gives the plant operator effective control over some of his most expensive supplies, steam, water, fuel, and the fluid ingredients of his products; measures not merely flow, but equipment, methods and men; and translates flow into dollars and cents, the language of business — into "greater production without waste," the language of a war economy.

Many and various are the stories that could be told of savings through flow metering. In considering just where to post these sentinels throughout your plant, the illustration Fig. 1[2] offers a pictorial guide.

Case after case could be cited illustrating the very obvious truth that in order to economize we must first measure, in order to stop a leak we must know it exists. And the ear of a flow meter is tuned to the silent leaks for it can "see" the hidden losses, or rather, it can enable you to see them—and stop them.

Management is beset by many questions these days to which flow meters supply the answers. Thus: How can we put emphasis on thrift and penalize waste in our various departments? Can we postpone modernizing our present boiler room . . . or must we expand it (priorities willing)? How large? What type? Is it possible to distribute our load better? Can we flatten the present peaks of steam demand?

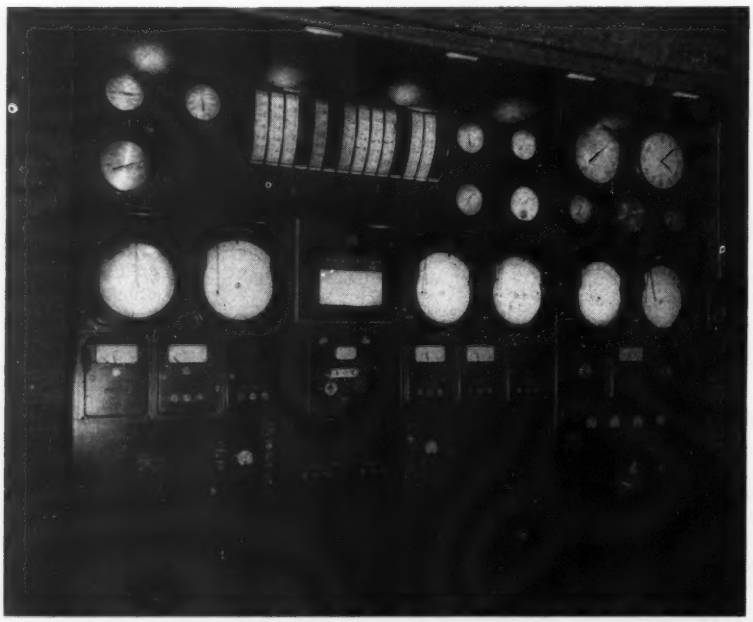


Fig. 2. This is the control station that runs the 225,000 lb. per hr. high-pressure steam generator at the Scovill Manufacturing Company, Waterbury, Connecticut

From this board a plexus of more than 100 electric wires, capillary tubes and pressure connection lines reach out to take the pulse of the unit. As in most panel boards, the top row is devoted to indicating gages for pressure and draft. At eye level are located the recording instruments measuring CO_2, boiler water level, boiler steam pressure, temperature and flow, feedwater pressure and flow, boiler blow-down, steam temperature and flow to the desuperheater. Below the recording instruments the combustion controllers are in easy reach for resetting or for manipulation of the push buttons. The smoke indicator (just below the multiple temperature potentiometer) extends to the stack itself to put the final exit condition under surveillance.

And when management, worrying where fuel consumption will go with expanding output and less experienced new operators, asks the $64 question, "How can we get closer supervision?", the answer is furnished by flow meters.

Steam flow out is the key measurement. On it is based all performance data, and, all other records are related to it. Efficiency of operators and operations are gaged by this end-result record. As an operating guide it is invaluable to determine when boilers are to be dropped from the line or picked up and what is the best combination of boilers and rating.

With this single record and a knowledge of his fuel consumption the operator has the basic set-up for simple accounting whereby he can determine his evaporation per pound of fuel burned and compare it with the performance of similar plants.

Feedwater is likewise a key record only second in value to steam flow. It gives evidence for study of the operation of pumps and level regulators and makes it possible to determine blowdown quantities.

After all, the measure of success of the operation is the efficient utilization of the fuel, i.e., most complete possible burning to liberate its heat and most complete possible absorption of this heat. The greatest percentage of heat loss in boiler operation is invariably that represented by flue gas leaving at stack temperature.

Therefore, chemical analysis of the flue gas by Orsat and CO_2 recorder to determine the completeness of the combustion and the amount of excess air employed to get it, plus measurement of stack temperature with a recording thermometer, supply the basic answers.

More detailed observations are needed to determine exactly what conditions are producing excessive loss. Ash and slag accumulations, broken baffles, infiltration of air into the setting, cleanliness of heating surfaces (both inside and outside) can all be detected by proper interpretation of flue gas analysis and of the flue gas temperatures leaving the boiler, leaving the economizer and leaving the air heater.

In addition, the following temperatures should be recorded: Superheated steam temperature to warn of excessive temperature of superheater tubes; feedwater temperature to help operator maintain boiler efficiency under existing load and to assure proper operating conditions of pumps, heaters and economizer; preheated air temperature, to avoid excessive expansion of stoker parts due to overheating.

Fuel, if liquid or gaseous, may be measured by flow meters. Measurement of Bunker C oil with head meters has always presented a problem which is avoided by use of an area type flow recorder with an electric transmission.

Because our subject is flow, we cannot dwell on other important recorders and indicators (shown in Fig. 1[2]) such as multi-pointer draft gages, the boiler water level recorder (measured by a meter identical in general construction to a flow meter) and the CO_2 recorder, basic criterion of combustion efficiency.

Table I. Boiler room instrumentation should give a complete check on every important point in the steam generation cycle

INSTRUMENT SERVICE	WILL CHECK THESE FUNCTIONS						
	Economy and Efficiency	Loading	Combustion Control	Feedwater Regulation	Personnel	Concentration	Safety
Flow—Steam Out (plus temperature and pressure)	X	X	X	X	X		
Flow—Feedwater In (plus temperature)	X		X	X	X		X
Flow—Fuel Input	X	X	X		X		
Level—Water Level				X	X		X
Flow—Continuous Blow-Down	X				X	X	
Temperature—Flue Gas	X		X		X		
Draft and CO_2	X	X	X		X		

Every engineer knows in a general way what flow meters are and what they do. Few, however, have a full appreciation of the potential value of meters and the practical aspects of their application, selection, installation and maintenance. This is the first of a series of five articles covering these practical phases.[1] Titles of the four parts to follow are: Part II, How Flow is Measured; Part III, How to Select the Primary Element and the Most Desirable Differential; Part IV, Where to Install the Orifice or Flow Nozzle; and Part V, How to Pipe the Flow Meter.

Flow measurement is a vast realm of industrial instrumentation and this series is restricted to a necessarily limited examination of just one type of flow meter, namely the head type meter. Consideration is also confined to fluids in closed conduits, thus eliminating weirs, flumes and other open channel devices. This head meter comes under the general designation of "inferential" meter for it measures, not, by physically determining the volume or weight of the fluid passing a given point, but, by measuring a phenomenon related to this flow.

It is a happy circumstance that the function thus employed for flow measurement can be created with relatively simple and inexpensive apparatus. Otherwise flow, being a quantity measurement, often would involve, for direct measurement, large and costly devices which would be subject to the transit conditions of the fluid itself. To Venturi goes the credit for the original observation, made at the close of the eighteenth century, that fluids in passing through converging pipes gain speed and lose head pressure while the reverse takes place through diverging tubes. Almost a hundred years had to pass before this fact was applied to flow measurement.

In 1885, Clemens Herschel, a New England hydraulic engineer, perfected and made practical use of a converging-diverging tube device to which he graciously bestowed the name of its Italian discoverer. Venturi tubes were used almost exclusively until about 1910, when orifice plates started to come into use. The Venturi tube, orifice plate and flow nozzle are all subject to the same theory and flow measurement by these means account for most industrial metering and are used to measure a Niagara of astronomical value.

Both as a plant control necessity, to fix ratios of materials in continuous operations, and for management cost accounting, flow measurement is indispensable to modern industry. Readers of these articles are assumed to be actively working with this type of instrument and familiar with its general construction. Therefore, the aim has been not to produce an encyclopedic review of available head meter designs but rather a discussion of the important consideration involved in their most beneficial and effective use.[1]

[1]This series of articles considers only practical flow meter use and installation for those reasonably familiar with general theory and construction. For a complete development of the theory and a comprehensive treatment of fluid measurement the author refers interested readers to the publication of the A.S.M.E. Special Research Committee on Fluid Meters. These are available in three separate volumes: Part I on theory and application covers the classification of all types of fluid meters, develops the theory, gives physical constants and meter coefficients and includes an extensive bibliography. Part II describes the individual makes of meters (both primary and secondary devices) in commercial manufacture. Part III covers selection and installation. These are available from the American Society of Mechanical Engineers, 29 West 39th St., New York City, at the following prices: Part I, $3.00; Part II, $1.75; and Part III, $1.50.

[2]For mechanical reasons Fig. 1, a full page chart showing good instrumentation in a modern industrial plant with boilers, auxiliaries, two types of turbines and process equipment, is placed on the last page of this section.

FOR THE STEAM ENGINE OPERATOR

Not All Saboteurs Are Enemy Aliens

By GEORGE HOLMAN

BY WHATEVER cause a needed machine is brought to a standstill, or by whatever means useful material is brought to the scrap heap, the result is the same and may be expressed in one word: Loss. A machine wrecked by the carelessness or ignorance of the operator or set idle by ignorance or lack of foresight of the management, is just as useless as it would be if brought to a standstill by enemy bombs. In fact, outage of equipment caused by poor management or inefficient operation is of greater value to the enemy than outage due to bombing.

In the first place the enemy would be spared the making of the bombs, the making of planes to deliver them and the gasoline, aviator-training, etc. required to effect delivery. Likewise a fire in the pile of storage coal, maladjustment of oil or pulverized fuel burners, holes in the fuel bed, cracks in the furnace setting, high uptake temperatures and a thousand other methods of unconscious sabotage contribute a small but measurable share toward the success of the enemy.

As an example of unconscious sabotage, I wish to cite the case history of a 26 by 30 in., 4-valve engine driving a 625-kv-a generator direct. This engine was installed in 1937, and from the time of its installation down to a few months ago has had more things happen to it than to most engines in a lifetime of service. At least a hundred major and minor things have gone wrong with this engine, not one of which was caused by the manufacturer or designer.

The first accident to happen to this engine was unquestionably the fault of the erecting engineer. Except for separator, throttle valve and exhaust valve connections, both steam and exhaust lines were of welded construction throughout. The oxy-acetylene welder, who worked under the direct supervision of the erecting engineer, failed to put backing rings under the welds. Oxide beads and icicles streamed through.

Before running the engine the erecting engineer either did not blow out this line, or blowing was ineffective. On starting, icicles and oxide scale were swept from the inner walls of the pipe and carried through the separator into the engine. Cylinder and piston and piston rings were scored, and both steam valves were ruined. However, the engine was accepted, conditional only that the valve seats be rebored and oversize valves lapped in.

While being run the engine operated smoothly enough. But on being placed on the line it became noisy. There were times when it became as noisy as a hammer mill trying to break up a case full of tramp iron. The noise was especially noticeable when the lighting load came on during the evenings, although why this was so no one tried to figure out.

The chief engineer, the maintenance man and one or two shift engineers tried various methods of eliminating this noise.

Adjustment of the governor was changed; the counterbalance on the flywheel was shifted; the valve setting was changed to show an ungodly poor indicator card; although not worn, the valve gear was in part replaced; and dashpot control was installed on the governor.

Many of these changes changed the tone of the engine, but the volume of sound remained the same, and at times got worse. The electrical system took up the problem of sound distribution. To determine whether or not this engine was on the line all one needed to do was to stop at or near any solenoid connected to the system, and listen. And there she was—or wasn't, as the case might be.

The erecting engineer and his assistant were recalled a half dozen times. They tried to find the cause of the racket, but at last gave up. Then one evening as the lighting load came on, the second engineer, who had diligently hunted for the noise for several months, happened to lean against the flywheel cover. He said later that the silence almost deafened him. He straightened up, and the noise resumed. He pressed on the cover, and again the noise stopped. Rubber cushions were placed under the cover where it bolted to the foundation, and the racket due to vibration was permanently diminished.

The cover had been picking up the customary sounds of the engine and stepping them up to much higher decibel levels. Why this should grow worse with the advent of the lighting load is still a mystery.

While cushioning the flywheel cover eliminated the cause of sound amplification, the countless changes already made had upset the engine design. Most of these changes were made by and/or at the instigation of the man in charge of engine maintenance. In this plant he was "Unconscious Saboteur No. 1."

In his wild search for ways to make the engine run better, he permanently spread the long leaf of the governor spring, broke a governor stop, shifted the eccentric this way then that and so tightened the cross-head wedge that the brass seized the pin. Bearing and pin were removed from the head while hot, and the bearing warped inward at the split.

Two or three times Unconscious Saboteur No.1 repoured and machined the crank bearing, and draw-filed the crank pin, which he claimed had been pressed into the disk when out of alinement. It was certainly out of alinement after he got through with it. Filings fell into the crankcase oil, possibly were removed by the oil filter. Once he set up the cross-head shoe so tightly that the heat burned off the paint on the outside of the cross-head guide.

An eye-witness of this accident told me that the to and fro motion of the cross-head could be followed by watching the red streak traveling up and down the engine above the guide. After draw-filing failed to make one of the oversize valves seat better than lapping in had done, Unconscious Saboteur No. 1 put a sheet metal disk behind it to hold it forward with the slot in the stem. What happened? The stem twisted off.

I dropped into the plant one day to watch his and his assistant's attempts at valve setting. "Three or four flats this way." Then after taking indicator card: "No; we went the wrong way. Back up three or four flats and go six flats the other way." A "flat" was one side of a hex gear rod. After extending the rods to their limits, he put off-set keys into the ways of the valve stems, and hammered on the gear chains. How this affected valve motion is anybody's guess.

Possibly due to Unconscious Saboteur No.1.'s efforts to set valves, and possibly due to priming, the engine grew more and more noisy until it was almost as noisy as when the flywheel cover was vibrating. The engine drew the greater part of its steam from a cross-drum boiler. Connections to the water column of this boiler were 15 ft. long. I was present on one occasion that this boiler was taken off the line for cleaning, the scale was so thick that a fine steel wire could not be forced through the pipe of the lower connection.

The only way water could show in the gage glass was by condensation of steam or by water high enough to flow in through the top. Carryover was bound to take place—and did. Recently, after Unconscious Saboteur No. 1. was replaced by a better man, the separator of the engine was opened for cleaning. There was 3 or 4 in. of sludge on the bottom, and the separator trap was full of the same. Neither this trap nor the trap on the main from the boiler had operated in months.

In this engine, oil is circulated by a small gear pump set in the crankcase and driven by a chain on a cog connected to the main shaft. Once this chain jumped off the cog and the operator failed to notice the lack of lubrication before the babbitt of the main bearing began to drag. This is a type of accident very likely to occur, and in the case

required no other remedy or prevention than taking up the slack in the chain at the idler. Yet Unconscious Saboteur No. 1, on taking the main bearing out for scraping decided that the wedge blocks did not have the proper angle, and proceeded to mill them off.

At about this time the management got the idea that the bearing had gotten too hot because the oil was too hot. With a room temperature of 95 deg. F. exclusive of radiation, the oil pouring over the main bearing was 126 deg. F. The chief came to me and asked my opinion of the oil temperature. By way of reply I set portable thermometers into the oil basins of a babbitt outboard compressor bearing and the windward end of a 40-horse slipring motor.

The motor bearing was 132 deg. F. and the babbitt outboard was 126 deg. F., with room temperature of 90 deg. F. I told the chief that I wouldn't worry if the bearings were 30 deg. hotter—if I knew they were getting plenty of good lubricant.

At times, especially when there was no carryover, this engine ran smoothly and well enough. At other times it didn't. In spite of the fact that it ran well on occasions, the maintenance man convinced the chief that the cause of the intermittent pounding was an undersize piston. He suggested that the piston be made to fit the cylinder more closely by hammering a flat bar of copper into grooves cut between the packing rings of the piston. The chief agreed to order the copper, and it was duly hammered into the grooves. This seemed to remedy the trouble, and for 2 wk. the engine ran smoothly.

Then the copper wore off and the pounding was resumed. After some discussion, the chief and Unconscious Saboteur No. 1. agreed on the purchase of a new piston. But not from the company that had made the engine, or from any other company with experience in designing and building engines. Oh, no! Their prices were too high, so they were not even consulted. Instead, a foundry got the order and pattern, and poured the rough casting.

With the assistance of Unconscious Saboteur No. 2, a machinist, the maintenance man turned the piston, which was hollow and plugged, and not of the bull-ring, follower plate type. They had decided to avoid the cost of a new rod. But in order to use the old one, the old piston, which was only slightly worn and of excellent material, had to be drilled and wedged off.

I dropped into the shop once during machining of the piston. The iron was full of blowholes, and looked more like the proper material for a low speed flywheel than for a steam engine piston. It was quite evident that no pressure leg had been poured to compact the grain.

I did not see the job when completed, but later learned that the piston had been machined 0.026 in. undersize to allow for expansion and working tolerances. The rod was not made a press fit, as the old one had been, but was left with only the nut to keep piston and rod together.

Contrary to suggestions from more than one engineer—myself included, although it was none of my business—that the cylinder be rebored, the piston was placed in the engine. After a 24-hr. run in tallow, the load was thrown on the piston. Again everything was lovely.

Contrary to my dire predictions, the engine ran 5 days before the piston seized the cylinder wall, and cracked in a score of places. I thought Aha! that's what comes of making a piston of poor material. But on inspection of the damage, I couldn't help but wonder what would have happened if the piston had not relieved itself by cracking. Had it not cracked, seizure would probably have resulted in a broken crank disk, bent crank rod and perhaps a cylinder head knocked off.

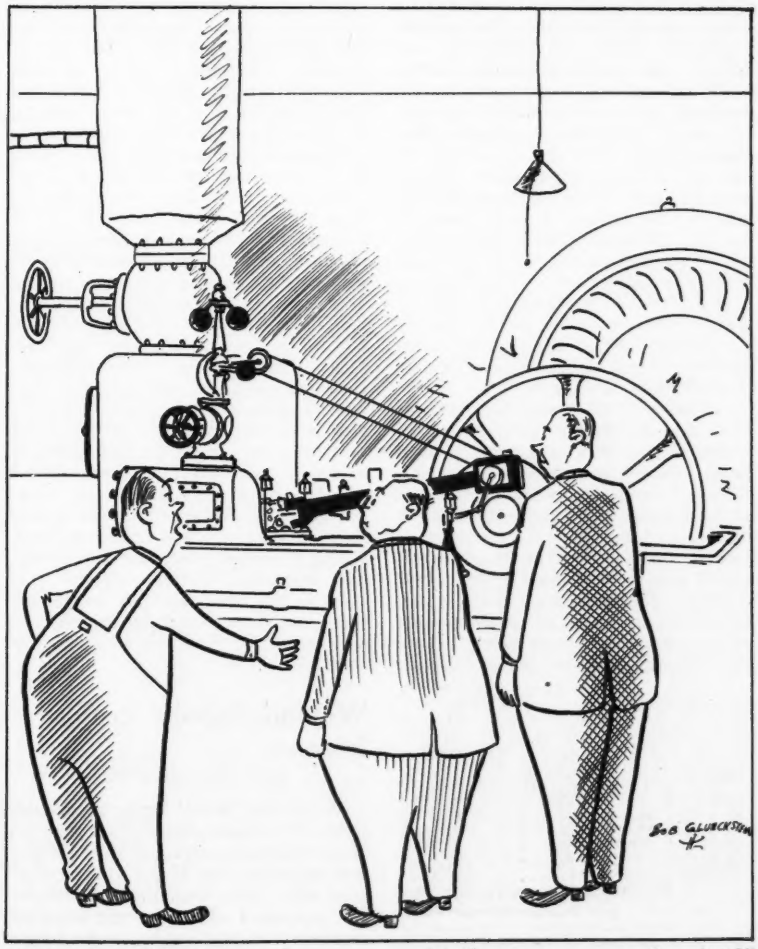
A new casting was procured from another foundry. The grain of this casting was excellent. The chief yielded to the advice of another subordinate, and the cylinder was rebored. Indeed, this was almost mandatory, due to hard spots where the piston metal had dragged off.

Reboring was in line with the crosshead guides. But in machining the piston, Unconscious Saboteur No. 2 got the hole in the piston too big for the rod. When set under the press, no pressing was necessary. The rod fell in.

After consulting the foreman of a welding shop, the chief decided to rectify the error by arc-welding. From the threads to the shoulder of the rod undercutting was done on a lathe, and with the rod at room temperature the welder began his work by laying overlapping beads parallel to the rod axis. Since it was desirable to get the engine back on the line as soon as possible, the built-up rod was not annealed or stress-relieved, but placed in the lathe and turning started immediately.

Whether or not the welded end of the rod was quenched, I cannot say. All parties to the welding deny this. The weld metal machined beautifully, with not a pin hole in sight. For some reason the chief decided to shrink the piston on the rod instead of pressing it. Don't ask me why. I don't know. The piston was heated to 750 deg. F. and the end of the rod dunked in dry ice.

I could never ascertain the oversize of the 5-in. rod. The chief said 0.008 in.; the maintenance man said 0.0045 in.; and the machinist said 0.010 in. Probably neither knew exactly. But the shrinking was effective, and the piston, now 0.060



"What if we did get it out of a museum.... It still generates power, doesn't it?"

in. undersize, or within 0.012 in. of the piston placed in the cylinder at the factory, was slipped into the rebored cylinder.

The engine ran 2 days. Early on the morning of the third day the engine developed an entirely new sound. It grew rapidly worse, and at noon the operator took it off the line. The piston was drawn and inspected, then laid on the floor with the rod pointing upward. It was the machinist who noticed that the rod appeared bent at the shoulder.

A new rod was procured and put into the piston at 38 tons. But when it was placed in the cylinder, the only packing available was the old set from the old rod. For a week, or until the packing wore in to fit the new rod, steam blew badly. About this time the frequency—of all things—began to cycle! But why go on with this.

What the involuntary outage of this engine during the last 5 yr. has been I am not in a position to know. Certainly it has been several per cent. And just as certainly the maintenance has been high. But the point I set out to stress is that not one whit of the damage done to this engine was by intent. Every operator and maintenance man had the best of intentions—the kind the road to hell is paved with. Yet few outright saboteurs could have done a better job of sabotage than they.

FOR THE BOILER OPERATOR

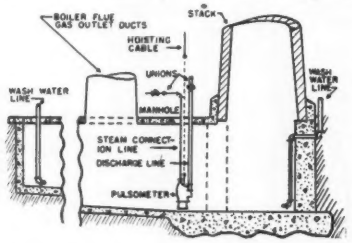
Pulsometer Cleans Underground Breechings

By S. H. COLEMAN

UNTIL the completion of new generating capacity at present in various stages of design or construction, the rapidly increasing industrial power loads incidental to the war production program must be handled by placing in regular operation numerous older stations until very recently held in standby service. It is also entirely probable that many of these stations will be called upon to carry load demands well above their normal rating.

Where this proves to be the case, fuel and maintenance costs will become a secondary consideration and the attention of the engineer will necessarily be directed toward the elimination of bottlenecks that limit maximum utilization of available capacity.

In many of these older stations turbines and generators can be operated well above their designed ratings provided sufficient steam is available. Although in the steam generating ends of these plants there is usually enough reserve fuel burning and forced draft capacity available to produce the required excess of steam, boiler output is quite frequently limited by the natural draft that can be obtained with existing stacks and breechings. These too will ordinarily be found adequate if all air leakage is eliminated and friction losses held at a minimum through the removal of cinder and flyash accumulations as fast as they are deposited.



Pulsometer as installed to clean a poorly designed breeching

Where breechings are located beneath the boiler room floor and are an integral part of the building foundations, a common layout in large stoker fired plants designed during and just following the last war, removal of these refuse deposits is quite often complicated. In one large plant falling in this category the problem of cinder removal is solved by washing out the breeching and stack base with large quantities of water and pumping the resulting slurry up to ground level for disposal with a pulsometer installed as shown in the drawing.

This device is nothing more than a pistonless steam operated displacement pump having two chambers equipped with suction and discharge valves. Steam enters these chambers alternately and is controlled by a ball or flap valve. Entering one chamber it forces the liquid contained therein out through a check valve into a discharge pipe. When the steam enters the discharge pipe it is condensed, producing a suction effect that throws the flap valve into position to start the cycle in the other chamber and at the same time draws up water through the suction valve filling the chamber just emptied.

Welded Repairs to Girth Seams

By O. W. MALARKEY

ALTHOUGH boiler codes specifically state: No repairs by welding shall be made without the approval of an authorized inspector, this is not always complied with. Many engineers have had the sad experience of having the inspector condemn a welded repair, made during the interval between the inspector's visits, and which the engineer thought was quite satisfactory.

This causes some hard feelings between the engineer and the inspector, perhaps even affecting a long standing friendship. The engineer is also confronted with the task of explaining to his boss that the welding job done by Handy Harry has to be undone and redone. Such explanations are not always easy to put over so that they stick.

These comments are not intended to give anyone the idea that the inspector's sanction on proposed welded repairs can be dispensed with, but to explain some of the requirements so that the engineer may better understand the rules. This will eliminate to some extent repetition of repairs in these days when careful scheduling of repairs is necessary in order that no production delays or interruption will occur.

If any job needs, but seldom gets, strict supervision it is one that is done by an unqualified welding operator. Unqualified operators are not always boilermakers (from the writer's experience they rarely are) and do not appreciate the factors that must be considered in doing any welding on a boiler. If left to themselves a botched job is practically certain to result.

As the inspector is not often present during minor repairs, the responsibility of supervising the job to a satisfactory conclusion falls upon the engineer. (The preceding does not apply to workmen sent out by the established boiler-shops or manufacturers who can often tell the inspector a thing or two.)

Furthermore, extenuating circumstances do occur, and it is unlikely that an inspector would exercise his prerogatives to the extent of refusing to accept a repair, satisfactory in every way except that due to an emergency and his not being available, the repair was undertaken and completed without his blessings.

Riveted girth seams, in general, always have been and probably always will be a source of trouble due to firecracks and corrosion caused by leakage. In many cases the trouble has been aggravated by a poor job of welding in attempting repairs. The accompanying sketches show common girth seam conditions that are covered by the "Rules for Repair by Fusion Welding" and the repairs that may be made by an unqualified welding operator.

Figure 1 shows firecracks that extend to, through, and beyond a rivet-hole, and, cracks from rivet-hole to rivet-hole. None of the cracks may extend beyond the edge of the lap of the inner plate. While no limitation is placed on the number of cracks shown in the first group this should not be interpreted too literally. Sometimes the cracks may be so numerous that the edge of the seam resembles the fringe on Leatherstocking's leatherjacket. A welded repair of that type would be out of the question, both from the standpoint of expense in making the repair and from plain commonsense.

Figure 4 shows the crack in the plate veed out to permit penetration of the

welding through the plate thickness. As repairs of this kind require overhead welding, small diameter electrodes are used and a number of beads are laid to fill the vee. Usually ⅛ in. rod is used with four or five passes made in a ½ in. plate.

Welding should not proceed back and forth without pause until the vee is filled as shrinkage may cause cracking either in or adjacent to the weld. After each bead is laid it should be cleaned of slag. While so doing the metal will have a chance to cool and the shrinkage strains will relieve themselves. This procedure should result in a minimum of distortion. Needless to say that the day of baling-wire welding is past and a heavily coated electrode having physical properties approximately that of the base material must be used.

Figure 2 illustrates permissible repairs to the corroded calking edge of a girth seam. In addition to being corroded the seam may also be firecracked. If the cracks do not exceed the limitations shown in Fig. 1, the firecracks should first be welded after which the corroded edge may be built up. Prior to welding the calking edge, all oxidized or burnt metal should be removed by chipping or grinding.

It would not be advisable to start welding from one end of the defective portion and continue to the other end, as a cumulative wave of distortion or stress would precede the welding and the plates would not lay up properly at the finishing end. To equalize stress and distortion it would be better to weld 6 or 8 in. in the center, then the same at each quarter position and so on until completed (think of how you tighten flange-bolts for even take-up).

Girth seams and rivet heads in girth seams may be seal-welded provided they are first tight under a hydrostatic pressure test. Figure 3 illustrates what is meant by seal welding and Fig. 4 what has often been done in the name of seal welding. The drawing at the right of Fig. 3, is not exaggerated as much as some may think.

Such a mass of metal is practically certain to cause trouble necessitating extensive and expensive repairs, one such instance resulted in a 21 in. circumferential crack and there probably have been worse cases. If properly done however, seal welding may mean the difference between a temporary and a permanent repair.

While adherence to the Rules may result in a satisfactory and acceptable repair job, the job is only half done if nothing has been done to prevent a recurrence of the trouble next week or next month by locating and removing or correcting, the primary cause. This may be scale, oil, flame impingement due to a faulty burner, or, localization of heat because of improper furnace design. All of these should be investigated to determine how much each may have contributed to the condition.

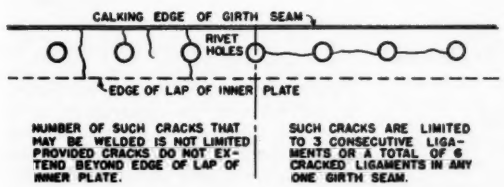

CALKING EDGE OF GIRTH SEAM
RIVET HOLES
EDGE OF LAP OF INNER PLATE
NUMBER OF SUCH CRACKS THAT MAY BE WELDED IS NOT LIMITED PROVIDED CRACKS DO NOT EXTEND BEYOND EDGE OF LAP OF INNER PLATE.
SUCH CRACKS ARE LIMITED TO 3 CONSECUTIVE LIGAMENTS OR A TOTAL OF 6 CRACKED LIGAMENTS IN ANY ONE GIRTH SEAM.

Fig. 1. Typical cracks through and around girth seams. Prior to welding the rivets through which the crack extends, and rivets on each side of them must be removed. After welding the holes must be reamed before new rivets are driven

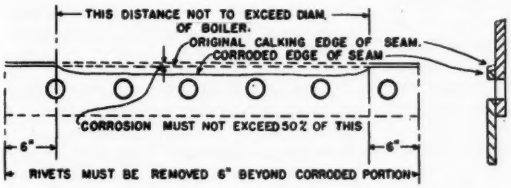

THIS DISTANCE NOT TO EXCEED DIAM. OF BOILER.
ORIGINAL CALKING EDGE OF SEAM.
CORRODED EDGE OF SEAM
CORROSION MUST NOT EXCEED 50% OF THIS
6"
6"
RIVETS MUST BE REMOVED 6" BEYOND CORRODED PORTION

Fig. 2. Limitations on the repair of corroded seams. Before welding, the rivets must be removed as indicated and the holes reamed before new rivets are driven

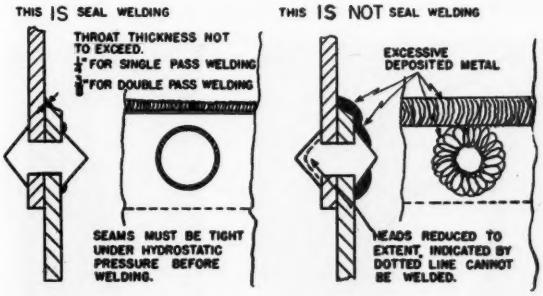

THIS IS SEAL WELDING
THIS IS NOT SEAL WELDING
THROAT THICKNESS NOT TO EXCEED.
¼" FOR SINGLE PASS WELDING
⅜" FOR DOUBLE PASS WELDING
SEAMS MUST BE TIGHT UNDER HYDROSTATIC PRESSURE BEFORE WELDING.
EXCESSIVE DEPOSITED METAL
HEADS REDUCED TO EXTENT INDICATED BY DOTTED LINE CANNOT BE WELDED.

Fig. 3. Proper and improper seal welding of seams and rivet heads for other than longitudinal seams of unstayed cylindrical shells or drums

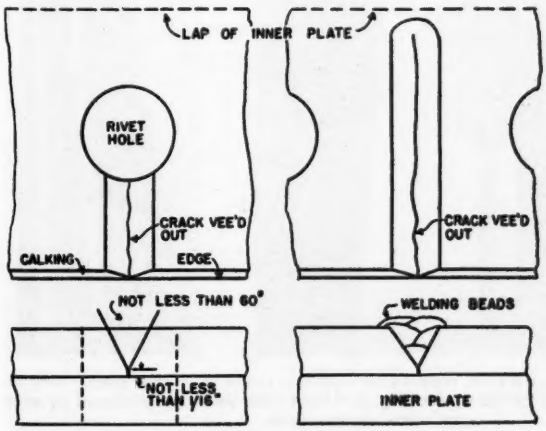


Fig. 4. Proper method of preparing plate for welding when the crack extends to, and beyond, the rivet hole

Heterodox Tube Cleaning. I

By ATOMIZER JOHN[1]

TUBE CLEANING in the average plant is the 'Topsy' of American industry. It just 'growed-up' of its own accord and it has been accepted and employed as such. Tube cleaners are common power equipment used for maintenance in most all steam-generating plants, yet strangely enough, knowledge of their construction, cost of upkeep and proper application among engineers, supervisors and operators is rare.

No quarter is asked in making this

[1]EDITOR'S NOTE: This is the first of a proposed series of six articles dealing with the practical phases of mechanical tube cleaners by an author who acquired his information the hard way and realizes that the "man behind the gun" is just as important as the gun itself. To get results that man must have good equipment, maintain it properly and know enough to use it effectively.

Sections planned to follow this general introduction to the series include: 1, Air Motors and Auxiliaries; 2, Drills and Cutter Heads; 3, Technical Data and Information; 4, Care of Equipment; and 5, Supervision and Use of Equipment. Unfortunately for users of cleaning equipment the Army had need of John (see p. 103 of this issue for the news and also a short prewar autobiography). John is naive enough to feel that he will have time to finish the series which shows that while he knows a lot about tube cleaners, he is woefully ignorant of Top Kicks, C.O.s. and Army life in general.

We are therefore running Parts I and II of the series which are already in the files with the understanding that the remaining sections will be used "when and if" received.

statement, for tube cleaning is one of the most abused and costly operations in our American industries. There are few tube cleaning jobs which the labor and cleaning equipment maintenance costs cannot be cut from one-third to one-half, if 'the powers that be' will look upon tube cleaning as a science or art instead of a 'necessary evil.'

The author's conception of the trinity involved in effective tube cleaner operation

It's time our mass producing American industries take the 'necessary evil old ghost' out of the industrial closet, give it a damned (optional may be omitted if offensive to the reader) good airing, blow it full of nice modern high-pressure air, stream-line the bulges caused by cobwebs and closet corners, put some oil on the squeaky joints and attach a new head (it may be necessary to put one on the boss, too). This will turn the old ghost into a sleek, low cost scale removing demon. Conditions today call for every man to get the lead out of his pockets, his feet on the floor and move at top speed even if he has to drive himself with a water-elm club.

If you know and agree with all the points brought out in the following sections they'll call you revolutionary, or crazy; if you don't agree with them, go on being orthodox, for what was good enough for father's teakettle is good enough for son's tubes.

Complete tube cleaning units have been made by three major manufacturers for many years but only a thin stream of vital tube cleaning information has percolated down to the men that actually use the equipment. Even today most of the information which can be obtained is descriptive and of little value to the man interested in improving tube cleaning methods and procedures.

It is not necessary to expound on the statement of vital tube cleaning data, any man who is in charge of one or 100 tube cleaners need only to check his tube cleaner files and he will immediately verify the fact there are some excellent pictures and sales talk enclosed, beyond that, vital tube cleaning information is largely missing.

Frankly, this is not a paper to credit or discredit any specific type of tube cleaner or manufacturer, it is intended to partly lift the veil and show tube cleaning is not a mysterious necessary evil, but if placed in the maintenance program as a technical problem instead of a 'black gang' ordeal, it can be speeded-up, costs reduced and costly down time minimized.

A large book could be written on tube cleaning and its application, for each cleanout is an individual problem. The tools used to do the job are precision power tools which must be given the same consideration, care and attention that is given any piece of machinery which may lose power with one or two thousandths of an inch wear on moving parts.

Tube cleaning has been retarded by the lack of true cooperation between the manufacturer and user of tube cleaning equipment.

Now this has turned into a double bitted axe which has cut deep into the manufacturer's and user's profits because they have failed to exchange information about how the tools were built, how they should be used and the performance realized in the field.

Tube cleaning research has cost thousands of dollars to both the manufacturer's and user's, yet I feel that the right hand knows not what the left hand does. The first prerequisite of reducing tube cleaning costs is to put the present equipment in efficient operating condition, then, from the improved performance, the savings in labor and shorter down time will pay for modern equipment which will actually clean at top speed and protect equipment.

Corroded Stacks Repaired By Welding

By C. D. COOPER*

DUE TO CORROSION from wind-borne fumes carried continuously in the same direction against the stack by prevailing winds, two 80 ft. stacks belonging to an eastern public utility company were badly corroded and were repaired by welding.

On one stack, shown by Fig. 1, the corroded sections were cut out and new $\frac{3}{16}$ in. steel plate welded in with Murex Genex electrodes. After the plates were in place the angle iron which had been welded to the stack to give additional support during the repair operation was removed.

Because of the height of the stacks and the size of the cutout sections, the job called for considerable skill, ingenuity and endurance. One of the features of the job was the construction of an especially designed booth in which the welder could stand and be raised and lowered at will with perfect safety. This is shown very clearly in the photograph.

Another stack, 110 ft. high, was not corroded but needed to be strengthened. This stack was reinforced with angle irons welded on the outside as shown by Fig. 2.

* * *

For protection against excessive pressures an automatic pressure limitator or cutout can be used, arranged so as to stop the compressor. This should be in addition to the regular relief valves and should be set below them so that in case of trouble the compressor is shut down before the relief valve opens. This avoids waste of the refrigerant.

*Metal & Thermit Corp., New York, N. Y. The start of the repair job described was shown in an article on page 89 of the December, 1940 issue.

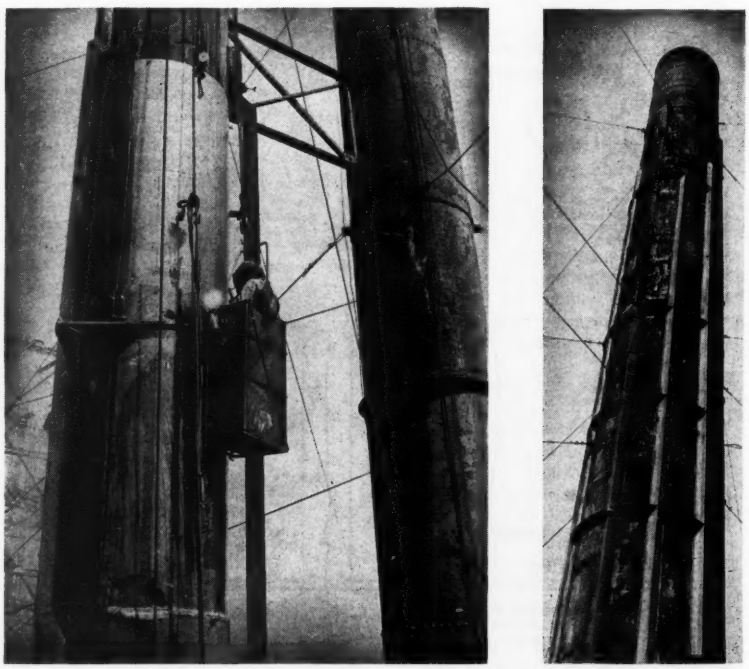


Fig. 1. (Left) This 80-ft. stack was repaired by welding a new 3/16 in. steel plate. Note the specially designed booth for the welder. Fig. 2. (Right) This stack was reinforced by angle irons welded on the outside

BILL MADDOCK says

Try This On That Orphan

Centrifugal pumps are like individuals, each with individual and family characteristics which make it difficult to generalize. There are only two safe ways to accurately determine the characteristics of a given pump: test it; or get the data from the manufacturer. Normally one course or the other is practical—but these are not normal times. Many pumps, long ago forgotten, will be put back into service and many of these will have the nameplate missing with perhaps not even manufacturer's name known. While we caution careful reading of the author's concluding paragraph, the method and charts presented should prove useful in many cases to give an approximation of desired data and serve as reasonably safe emergency measures

Did you ever look for a name plate on a centrifugal pump to get its rating and find it gone? Or should the question be, "Did you ever find one with the name plate still on?". Right now, more than likely, many operators are looking over the old discarded heaps in search of suitable pumps to augment or to replace a broken down unit.

Sometimes enough data can be gleaned from the markings to enable the manufacturer to supply the ratings and characteristics, but today with their overtaxed engineering force this service takes time. Unless you are really in need of accurate test curves, here are two general curves that will be of considerable help in deciding whether a pump is suitable for the service intended. It is very simple, and will work on nearly all but special built or turbine pumps. For old pumps the results will be as reliable as the new test curves. Here's how.

First clean, pack, oil, and test for rotation. If you are not sure of the design, speed run at 1750 r.p.m. for pumps under 10 in., 860 r.p.m. for 10 to 18 in., and 580 r.p.m. for 18 to 24 in. sizes. Hook up the suction to a source of water. The quantity is not important because all that is needed is the dead head or shut off pressure. The discharge may have a valve or be blanked with a blind flange. Be sure the pump is primed. Start, bring up to speed and quickly take the discharge pressure reading. The test is very simple and, if the gage is mounted on the pressure side and read before and after the pump is started, only one gage is needed. But the pump must be thoroughly primed. Do not run a pump very long with the discharge closed or it will heat and very likely seize and be damaged.

Now armed with the discharge size (use the suction size if the pump is less than 3 in.) and the dead head pressure, you are ready to attack the curves. By way of explanation, Fig. 1 is a composite of test curves and is good for single-stage, double or single-suction volute pumps. From this curve it can be seen that the dead head pressure is usually 1.32 times the rated pressure. If the shutoff head is divided by 1.32 the rated head is found.

For example, assume that a 6 in. pump had a dead head pressure of 150 ft. of water (150/2.31 or about 65 psi. pressure). The rated pressure would then be 150 divided by 1.32 or 114 ft. Remember? That was one of the things you wanted to know. If the maximum head needed was between 114 and 150 ft., the pump might do. If you need more than 150 ft., speed this one up, or look for another pump.

But if the head is OK continue with the curve in Fig. 2. This curve gives the capacity of the pump in terms of pressure and size. Run up the 6 in. pump line to 114 ft. and read the capacity to the left. It is about 1200 g.p.m. The story may be continued further by going back to Fig. 1 and tailoring it to fit that particular pump; 100 per cent flow becomes 1200 g.p.m.; 75 per cent, 900; 50 per cent, 600; and so on. Also 100 per cent head becomes 114 ft.; 110 per cent, 125 ft.; 120 per cent, 137 ft.; and 132 per cent back to the original 150 ft.

The expected new pump efficiency can be obtained by following the capacity line to the right to the efficiency line and reading the result at the bottom. (in the sample case- 82 per cent). It is possible to work out the same thing

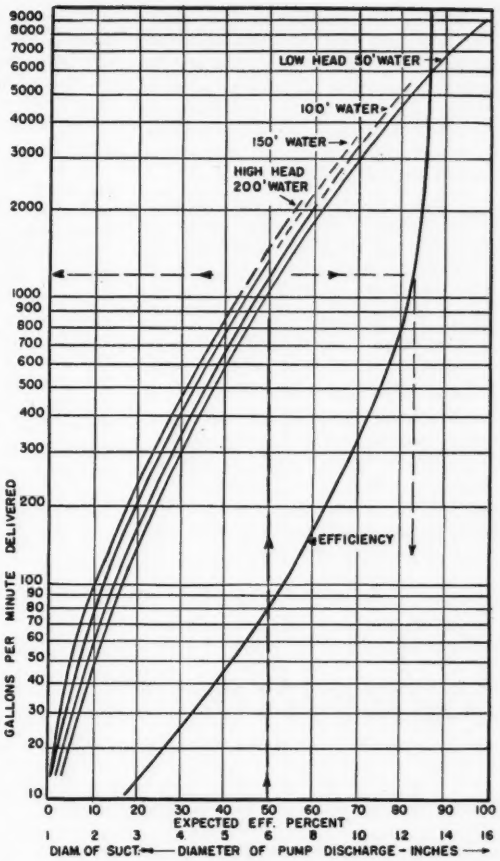


Fig. 2. Chart for approximating the performance of a single stage centrifugal pump from a single reading of the heat at shutoff. The example shown by the dotted line is for a 6 in. pump which showed a shut off head of 150 ft. when tested. The usual operating point works out as about 1200 g.p.m. at 114 ft.

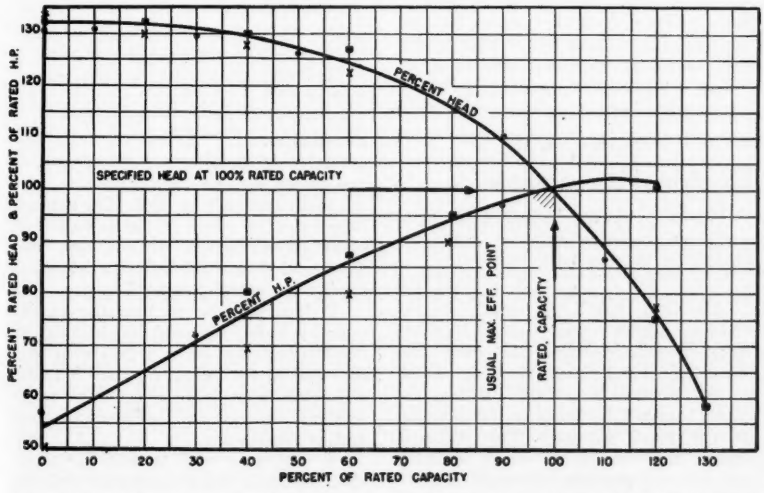

PERCENT RATED HEAD & PERCENT OF RATED H.P.
PERCENT HEAD
SPECIFIED HEAD AT 100% RATED CAPACITY
PERCENT H.P.
USUAL MAX. EFF. POINT
RATED CAPACITY
PERCENT OF RATED CAPACITY

Fig. 1. Typical single stage centrifugal pump curve showing the relation of head and power input to capacity

on multi-stage pumps, but the rated head pressure must be divided by the number of stages when getting the capacity from Fig. 2. That is a 3-stage, 6 in. pump having a rated head of 342 ft. will have the same capacity as the 6 in. single-stage pump with a rated head of 114 ft.

In time of emergency, over capacity is no problem. If the dead head test shows that the pump has much too high a head, try reducing the speed. If that is not feasible the head can be cut by trimming the runner.

$$\frac{(\text{New Diam.})^2}{(\text{Actual Diam.})^2} = \frac{\text{Desired head in ft.}}{\text{Test head in ft.}}$$

Of course the capacity will come down some, but will be reduced only in proportion to the diameters and not as the square. It is a tricky job to increase the runner diameter so if the head is too low about the only way out is to increase the speed.

$$\frac{(\text{New speed})^2}{(\text{Test speed})^2} = \frac{\text{Desired head in ft.}}{\text{Test head in ft.}}$$

Here the capacity will go up but only in direct proportion to the speed.

Knowing the capacity, head and efficiency the power input to the shaft can be approximated by multiplying the capacity in g.p.m. by the head in feet and dividing the answer by 40 times the pump efficiency in per cent. When selecting a drive for low capacities it is well to bear in mind the shape of the horsepower curve of Fig. 1 and allow some leeway. If not the drive will be overloaded if the pump should be operated against low head or with a free discharge.

The writer grants that the results obtained by the curves might be classed as only a guess, but it is a good guess and more often than not a pump can be classed as suitable or not without the expense of a measured water test nor the delay in securing the manufacturers' ratings.

Questions and Answers

Question No. 193

Locating Leaks in Buried Vacuum Lines

BECAUSE of leaks occurring in vacuum return lines I am faced with the problem of locating these leaks and stopping them. The line in question is 2½ to 4 in. steel pipe enclosed in terra cotta pipe underground. It runs for approximately 200 ft. at an average from 2 to 3 ft. below a 5 in. concrete floor. There are a number of branch lines entering both from beneath the floor and also through the concrete floor from above. My problem is to find the exact location of the leaks so that the minimum amount of floor need be torn up and also so as to give the minimum amount of interference to machinery and production on the floor. How can this be done?

The Cromar Co. I. D.
Williamsport, Pa.

Question No. 194

Who Knows About Bees?

OUR FIELD men are operating about 40 water level recorders and might just as well be operating 40 apiaries. Perhaps we should round up a drove of entomologists to find out what can be done about bees in the recorder shelters, although this does not seem practical at the present time. We have tried oil, gasoline, etc., and the little hot-tailed devils thrive on it. They can also get through the best screens. Is there anything that can be put in the shelters to discourage them? The mud dauber wasps ball up the float cables and the hydrographers swell up like small-time politicians or college professors on a priority board.

Sacramento, Calif. D. S. S.

Question No. 195

Electrical Unbalance

WHAT IS meant by the term electrical unbalance, a term we note frequently in Westinghouse literature?

N. V. SVETAILO

Electrical unbalance refers to the vibration which results from unbalanced magnetic pulls between the rotor and stator of a generator. A rotor which is not accurately centered within the stator bore will be pulled in the direction of the small air gap. The magnetic pull in this case is stationary in space and will not produce vibration.

On the other hand, a rotor which is running eccentrically in the stator bore will have acting on it a magnetic pull which revolves with it and a vibration of the rotor itself will result. If this rotor is machined true or is balanced so that its surface does not present an air gap which varies with rotation, the unbalanced magnetic pull or electrical unbalance will be eliminated.

Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pa. B. A. ROSE

Answer No. 157

Checking Up On An Old Engine

DUE TO THE WAR N. Y. is considering putting back into service an old outside crank engine, reported to be out of alinement, not in very good shape and with a history of flooding the cylinder from the barometric condenser. On p. 93 of the March issue he asked for help on checking the engine over. The article on p. 90 of the August issue was adapted from a direct answer to this question. Another reply was published on p. 98 of the September issue and here is still another.

This One Goes Into Even Greater Detail

WE NOTE a query by N. Y. about checking up on an old engine. This becomes necessary sometimes when an old engine has been allowed to stand idle. It deteriorates under such conditions till it is of doubtful value. Then an occasion may arise when it is expedient to use it for part time service or offer it for sale to some prospective buyer. It takes a well posted and experienced engineer to determine the prospective value of such a piece of apparatus.

In the first place it would be desirable to assemble all the data, serial number, history of the piece of apparatus, whether repair parts could be still secured from the manufacturer, and look up the records of just what difficulties had been experienced in its previous operation.

Then I would make a thorough inspection to determine its physical condition, its state of wear, and whether in perfect adjustment or out of line. If it has been out of use for too long a time it will not be safe to try to start it up under steam as it might be rusted fast somewhere. Better turn it over carefully by hand if possible to see if everything is clear.

We are liable to find piston rings rusted fast in their grooves; valves in same fix,—bearings out of line, and worn, and should not be operated before having a general overhaul.

If it is possible to turn the engine over by hand, I would block it on its dead center and let a little steam into that end of the cylinder to see if steam will issue from cylinder cocks at opposite end and test for tightness at other end in some way.

It would be well to test the clearance on each end of cylinder with the steam shut off and engine pulled over by hand, by inserting a No. 6 insulated

wire into the opening inside of cylinder wall at the end of the cylinder where indicator connections are brought out. Turning the engine over the center will crush the insulation on the wire so that the thickness left will show the exact clearance at that end. Then try the other end the same way to determine if the clearances are equal.

If so make some tram marks on the surface of the crosshead and on the piston rod near the crosshead so that in case we unscrew the piston rod out of the crosshead to dis-assemble the engine we can properly relocate it when putting it back.

One of the first things we should do is to apply a special engine-builder's level to the main shaft to see if it is level; also to put reference marks showing the present position of all the adjustable points on the engine, including to what depth all pins and wedges are driven. This can be done by prick-punch marks set on say 6 in. centers between the permanent parts of the bedplate and movable parts; or, by laying a small steel scale alongside pins or wedges and drawing a scribe mark across.

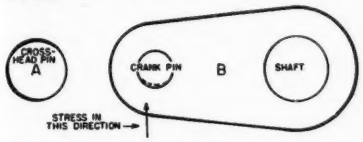


Fig. 1. On an engine running over the crosshead pin (A) shows a tendency to wear and show flat spots where the pressure is the greatest. The crankpin wears and gets flat on one side only, because after the engine goes over the center the same side is stressed

After we get everything thus marked so we know what the original adjustment was, then we can safely proceed to dis-assemble the engine parts keeping careful track of all liners we may find in the bearings and identifying and making note of their position.

After taking the engine parts down (including opening the cylinder and removing the piston and dis-assembling all the bearings) we can begin to check up on the wear of the parts and here is where a good pair of micrometer calipers comes in play.

In this article we refer to the piston head as being of the type of solid piston head with grooves and packing of the sprung ring type, more expensive engines have a piston of the built-up type with adjustable bull-ring and packing rings by which the piston rod can always be kept central where it comes through the gland.

Some engineers are willing to let well enough alone as long as the engine is running without trouble, but we believe the best and most progressive engineer is the one that gives everything a periodic check up so as to cure such troubles as bad alinement before they become serious problems and yet while they can be easily remedied.

We recently revamped an old Corliss engine that had a main bearing shaft in the bearing that had worn flat on one side, but after re-babbiting the quarter boxes and making a trial run with plenty of grease applied, we succeeded in getting it to run without heating.

We may expect the bore of the cylinder to be more or less out of round, the piston sprung-rings to be worn or out of tension and evidences of steam leaking past. These signs are easily detected by the experienced eye. The piston may be riding low in the cylinder and the rod "down" where it passes through the stuffing box. Also look for signs to see if the piston has been down enough for the rod to ride on the packing gland.

If the cylinder is found too much worn it may be desirable to have it rebored and equipped with new piston head and rings. After piston, crosshead and crank have been removed we now are ready to find out if the main shaft is square with the piston and working parts in line and level.

We do this by bolting a piece of board across the back of cylinder over the stud-bolts. At the center of the board bore about a 1½-in. hole and cover the hole with a small sheet of tin tacked on; then determine the exact mathematical center of the head of cylinder by measuring out from the counterbore with a pair of hermaphrodite and adjustable calipers with a scriber on one end.

Then prick a small hole in the tin at center large enough to pass the string we are going to line with. This string we pass through the cylinder and out past the crank disc; centering it carefully where it passes through the packing gland—or rather the orifice where the gland belongs (we having removed the gland temporarily). We now can measure in from the line to the crank-disc and determine whether the main shaft is square with the piston.

Also we can by measurements determine if the crosshead is "down" and note whether it is necessary to re-babbit it on under surface or whether, if low, it has an adjustable shoe under it, or, if there is an adjustable lower guide that can be adjusted to raise the crosshead to its proper position.

Next we turn our attention to the cross head pin to see if badly worn. It may be a removable type of pin, or made in one piece with the crosshead. If the engine runs over, we may expect the pin to show wear as noted in Fig. 1, as the pin invariably wears fastest and becomes somewhat flat on the surfaces where the greatest tangential effort is transmitted to the crankpin.

Also note the cross-head brasses; they wear also at points where greatest stress is transmitted. If they show sort of blue or overheated at top or bottom it indicates that they are pinching at these points and should be spotted and scraped and relieved at these points.

Next we will look at the crank-disc and the crank. We should examine for looseness of the pin in the disc. Also put on a square to see if the crank is absolutely square with the disc on all sides. Also use the calipers on the pin and see if all diameters are the same.

Pins in use for a long time invariably have a flat spot on one side only. If you study the proposition a little you will note that the greatest tangential effort always occurs on the same side of the pin; as when the crank turns over it presents this same side to the pressure part of the box. Examine the crosshead brasses and the crank boxes for proper condition of oil grooves.

Now about the main and outboard bearings:

If the engine is built like an engine ought to be, the main bearing will consist of a bottom babbit lined piece, a top cover and a quarter box on each side of the shaft, each with its wedges and retaining bolts, or, maybe the wedge is found on front side only with rear wear taken up by putting in liners only.

The outboard bearing generally is equipped with setscrews for adjusting the bearing fore and aft and an adjustable wedge for raising and lowering it. By experience in checking up on engines we find that on many engines the main shaft gets out of square with the piston on account of the most wear being in the direction of the belt pull.

It is well to keep a constant check on the alinement of an engine by having reference caliper marks on standard distances laid out from the shaft centers to parts on the bedplate. Then if you have a hot box and lose some babbit out of a bearing and the bearing becomes low you can restore it to its former alinement marks by referring and measuring to the old reference marks.

If an engine be allowed to get too far out of line and then drastic changes are made to restore it, when first started up you must look out for hot boxes as of course there will be some difference in the fit of the bearings. On the other hand, if the engineer keeps a check on the alinement of his engine he will probably not have such bearing troubles. In renewing crosshead brasses, if the pin is worn flat on the sides it takes a careful job of spotting and scraping to get the parts to run cool.

We have said nothing about the overhaul of the engine valves. This depends on what kind they may be. We leave this to the common sense of the engineer. Also the examination of the governor mechanism and an inspection of the flywheel for broken hub or rim bolts or for looseness on the shaft also hammer-test the arms and test for cracked arms near the rims.

Logansport, Ind. C. C. CUSTER.

Answer No. 171

Will a Steam Compressor Help Him?

On p. 122 of the May issue P. R. O. who operates a laundry with one 125 hp. boiler and a 70 hp. engine, says that he has found passing high-pressure steam through the mangle at high velocity increased production about 30 per cent. He wanted to know if it would be possible to return this steam to the boiler without loss.

The following answer does not cover this point directly but does have a bearing on efficient laundry operation. Incidentally, steam has about the same expansion coefficient as air and compressors are being used successfully by several laundries which purchase low-pressure steam from district heating companies but need small quantities of high pressure steam for ironers, etc.

First Get Heat Distributed Properly

P. R. O. would like to know if it is possible to install a pump that would put steam as well as condensation back into the boiler, for he states that they have speeded up the steam flow and found that it increases production mangle about 30 per cent. I assume he would like a circulating pump so as to circulate steam through the machines then back to the boiler.

As this is a laundry plant, I can see that there should be lots of steam, especially if there are no excessive leaks in any of the equipment that use steam. Certainly he can put steam back into the boiler, but I believe it is practical only after the form of it is changed, i.e. as return condensate. Fassing steam at a high velocity through the mangles should give better production. This is simple for if the mangle does not have traps the steam will flow directly through it and in this way maintain a steady high velocity flow and give high temperature. But then this causes waste which every plant engineer and superintendent wants to keep down.

What I think should be done in P. R. O.'s plant is first to get the heat into his dry-rooms, tumblers, mangles and water heater in the proper way. This calls for proper layout and size of steam piping as well as return lines and traps. There should be a direct steam line to the dry-rooms, also one to the tumblers (one steam line to each tumbler) and a direct steam line to the steam chest of the mangle. As each of these machines have individual steam lines, they should have individual return lines, and they should be properly trapped. When these are of the proper size I believe that most of, if not all of, his troubles will be eliminated.

To find out if the mangles are putting out the right heat for each roll, a representative from one of the larger trap concerns will come out and assist P. R. O. in checking the heat from each roll by taking pyrometer readings. I found out that these representatives are only too glad to help out, especially where some of their equipment is concerned.

It is not always the steam temperature that is to blame for poor results, nor the equipment. In one particular case where I was employed in a laundry power plant, we had a bit of trouble locating the headache of our mangles. We had plenty of steam pressure and at that pressure we should have had a good temperature. After calling the trap company, a representative came out, looked over the layout and asked questions here and there. He got a good idea of what the trouble was, although the chief was a hard headed individual, difficult to convince.

The representative told the chief he would let him know the source of trouble in an hour. With the pyrometer he took readings of each roll while no work was being run through the mangle and then the work was run through. What a difference was found! After this the presses were tested and the same trouble found.

The headache was caused by the clothes not being extracted properly. That meant there was considerable water in the clothes, small yet enough to cause plenty of loss of production by having to run it through the mangle again. The goods being too damp, however, was only one of the troubles. The other was two traps (small type) not working and a return line too small to take care of the 8 mangle traps, 3 tumbler traps and 15 presses. After these were taken care of we had no more trouble. Checking of temperatures on all machinery to make sure we were getting the utmost efficiency as possible made us much wiser.

The nearest practical piece of equipment for putting steam back into the boiler would be the steam trap for it puts the condensate back to the receiver, hotwell or feedwater heater as soon as steam changes its state from a vapor to a liquid. A deaerating feedwater heater is certainly a nice piece of equipment to have and it will pay its way as far as a help in the generation of good, clean steam.

As for a surplus of exhaust steam, our plant added another hot water tank, about 70 per cent the size of the original tank. In this way the exhaust from the engine took care of the hot water output in the summer, with no use of the steam line which we had hooked up to the hot water tank to boost the temperature in the winter months. This line was controlled thermostatically. In the summer the thermostatic control was removed, cleaned and checked, so as to make sure it would be O.K. for the following cold weather. The addition of the second hot water tank helped a great deal as the water circulated between the two tanks when it wasn't being used.

Philadelphia, Pa. William T. Mullen

Answer No. 174

The Best Way to Lay Up Boilers

Laying up of boilers for any length of time, in this case 8 mo. (as referred to by J. R. on p. 78 of the June issue), requires the best efforts any engineer can put forth. It is during this idle period that the two evils, corrosion and deterioration, get in their body blows.

Years ago the laying up of boilers was a comparatively simple job. Usually the fireman, hired for the season, would pull the fire, drain the boiler and then report to the office for his pay. Little if any attention was given to the equipment until it came time to put the plant back in service again.

Today with the economics or the cost of boilers and equipment, involved in the generation of steam, the engineers are taking better care of their plants, so much so, that the laying up of boilers has become almost a science.

There are two methods accepted as standard practice for laying up boilers—the wet and the dry methods. The wet method involves the filling of the boiler with chemically treated water, constant checking of the water and the ever present danger of small leaks that may go undetected until serious damage occurs. This method is not to be encouraged except under special conditions and then only for a short period of time.

By far the best and the most popular way of laying up boilers is the dry method. The following are the most essential points to remember in carrying out this method.

After the fire has been pulled, the boiler should be cooled down, making certain that the brick work is cold before attempting to empty the boiler. This is very important because if the boiler is emptied before the brick work has cooled sufficiently, the solid deposits may be baked on the heating surfaces making the removal of these deposits rather difficult.

As soon as the boiler has been emptied, it should be flushed with clean water, preferably under pressure. This will remove a considerable amount of loose scale, sludge and mud. The boiler should now be dried out either with a light wood fire or hot air stoves, taking care not to warm the boiler so that it would be uncomfortable to the hand.

The boiler should then be cleaned, internally and externally, the tubes turbined if necessary, the ashes removed, smoke box and breeching cleaned out, the steam gage and siphon pipe removed and stored in a safe place. This should always be done in order to prevent a possible mechanical injury to the gage and damage to the siphon due to the freezing of the water in the pipe should the weather turn cold during the idle period.

All valves should be overhauled and then closed, leaky pipe and joints repaired, the roof over the boiler should be examined for possible rain leaks. You can mark the leaks on any rainy day and then repair them at your leisure.

After the boiler has been thoroughly cleaned, turn your attention and your broom to the boiler room in general for a good house cleaning never hurt any boiler room. When you have everything back in place again, call in your boiler inspector. This is the time that you and he should go over your plant because a small defect discovered and remedied now will save many dollars later on.

The inspection of the boiler completed, all of the external parts including the accessible parts of the heating surfaces, the piping, supporting structure, breeching and all exposed metal should be given a good wire brushing and then painted either with red lead, orange lead, black japan, tar paint or aluminum. If you wish to and can stand it, you can paint the parts with a mixture of graphite and fish oil.

With such a going over, your boiler should be nice and clean. Now get 20 lb. of quick lime for each 100 bhp. capacity and place the lime in open boxes. Set the boxes about the boiler, in the drum, the headers, the fire box and throughout the setting, after which all the man hole plates, hand hole plates, setting doors, fire doors and all other openings and connections on the boiler or in the setting should be tightly closed.

It is recommended that about every 2 or 3 mo. the boiler should be opened up and the lime renewed if it has become slaked, this also affords an opportunity for an examination of the boiler during its idle period.

The damper to each boiler should be closed tightly and if possible, the stack itself should be covered. In the average battery installation, a number of boilers share a common stack, this of course, prevents covering the stack unless all the boilers served by the stack are to be laid up.

If the boiler room becomes damp, during the idle period, it is advisable to sprinkle quick lime around. If there is a watchman on the premises, he can fire several charcoal salamanders in and about the boiler room to aid in keeping the place dry or at least to reduce the amount of moisture present. For a recognized authority on the above question, consult the A.S.M.E. Suggested Rules for Care of Power Boilers,[1] paragraphs c-244 to c-248 and c-255.

By all means, never leave idle boilers or for that matter, any kind of equipment, uncared for for any length of time. A periodic examination at regular intervals will pay big dividends when you want to use the equipment again.

Williamsport, Pa. KARL A. PIPPART

Drain Them and Clean Them

IN QUESTION No. 174 J. R. states that the boilers (steam generators to us) are laid up for a period of 8 mo. This is a much longer period of shut down than the average plant has. For a long lay up, therefore, it is usually better to empty the boiler and clean thoroughly inside and out.

External surfaces should be cleaned of all scale and soot that accumulate and lay where the soot blower elements cannot reach them. All ashes and slag should be removed; ashes may contain sulphur, if so, moisture may be absorbed forming sulphuric acid which in time would attack the metal surfaces of the boiler. The main idea therefore is to keep the boiler as dry as possible.

Many engineers prefer to use Apexior for coating the inside of boilers. The writer has inspected a boiler 6 yr. after Apexior coating was applied and found the original down to metal cleaning marks. For tubes it is applied with a tube brush equipment. External surfaces not subject to the fire are usually cleaned thoroughly and red leaded.

For best results therefore all dampers should be closed to prevent circulation of air which causes sweating. The boiler room being damp (in J. R.'s case) a simple remedy can be had by putting a container of quick lime on the grates of coal burning equipment and on the boiler floor with oil burning equipment, so that any moisture entering the boiler will be absorbed by the lime. If the dry method of laying up a boiler be used it may be advisable to put a pan of lime in the drum.

Some engineers prefer to fill the boiler full of water to allow as little air space as possible, and to resist corrosion some excess of soda ash should be added to the water. The best procedure in filling the boiler with water would be until the safety valve starts to lift, then shut off the water quickly. Of course an air vent should be situated at the highest point in the boiler to allow the air in the boiler to escape when filling same.

Manhole openings have a special ring of metal fitted around the manhole opening in the drum. The surface where the manhole plate rests on should be cleaned thoroughly. Manhole plates should also be cleaned thoroughly and lined up with the manhole. If the proper size gasket is used and the gasket calls for the pressure carried on the boiler, no difficulty should be experienced with having a non-leaking plate.

Engineers at times fail to go back and check up on a manhole plate. Some fail to tighten them up slightly after the boiler pressure has been applied for several hours. When a manhole plate is set up it should be centered properly. Many engineers also prefer to use a mixed coating of cylinder oil and graphite on the gasket. There are gaskets on the market that require only a soaking in water before they are used. Therefore, a non-leaking manhole will present no corrosion problems or knife edging of the manhole opening if manhole plate is installed right.

Fairview, N. J. MARTIN N. GOZDENOVICH

Vincent Checks Others On All Points

THIS QUESTION does not state that the boilers are to be put into service quickly or not, so I take it they are not. The usual procedure is to empty the boiler, clean the tubes and drums and dry out thoroughly inside and outside. Clean the furnace, paint all outside surfaces with heavy oil and graphite. Close the dampers and seal them with asbestos rope or cement. Place in drums, shallow boxes (preferably wood) filled with unslacked lime. Also place some of these trays in the furnaces. Close manholes and furnace openings to prevent the circulation of air and sweating. The lime will absorb any moisture that may enter.

Brooklyn, N. Y. VINCENT HARRON

[1]This section of the code may be purchased separately for 70 ct. from the American Society of Mechanical Engineers, 29 W. 39th Street, New York, N. Y. The complete code (8 sections) sells for $5.50.

Answer No. 175

Ed's Engine Works Down But Not Up!

AN ODD INDICATOR card from a 15 by 20 in. vertical Fitchburg engine (substantially the same as the following Fig. 2) was reproduced on p. 78 of the June issue. It drew fire from E. MacDermod (p. 95, August issue) who having a suspicious nature, intimated that the card was a fake. This was hotly denied by Ed, who for proof, sent through the whole story, but not in time to be used in the August issue. Only those who have operated vertical pumps and engines knows they are prone to certain ills and complaints not shared by the horizontal species. Anyway Mac, who stated to begin with that he had never seen a vertical Fitchburg apologizes to all and sundry for his suspicions and we trust everyone is happy again.

Ed Denies the Allegation and Defies the Alligator

You (referring to Mr. Mac Dermod) are unfair both to POWER PLANT ENGINEERING and to me when you say that I am not on the 'up-and-up' about the card reproduced in the June issue. P.E.&E. is doing a very good job publishing troubles so that others can see and discuss them. That card was sent in in good faith, so that the boys could look it over and tell me what was wrong with the engine. The P.E.&E. Editor told me what was wrong with it right away and did not tell me that I dumped the load on one end.

You say that the load was dumped off from the crank end. Well, perhaps it could be, but that was not done on this card. Did you ever take any cards from a vertical Fitchburg engine running at 135 r.p.m.? If you did you know what I mean when I say perhaps.

I am sending three cards from the same engine which incidentally was put in this plant second hand. Cards No. 1, No. 2 and No. 3 taken with a 2 in. reducing wheel. They tell me the Fig. 1 card was like that from the day that the engine was put in and the man that the company sent could not tell them what was wrong with it. A good many more looked it over too with no better luck.

Nuts on the crank end steam valve were apparently not tightened properly for they eventually worked loose. When they came off the valve dropped and the engine stopped. We had to find out what was wrong and fix it. We did get it started and that gave us the Fig. 2 card. Then using the same marks that were on the valve rods we

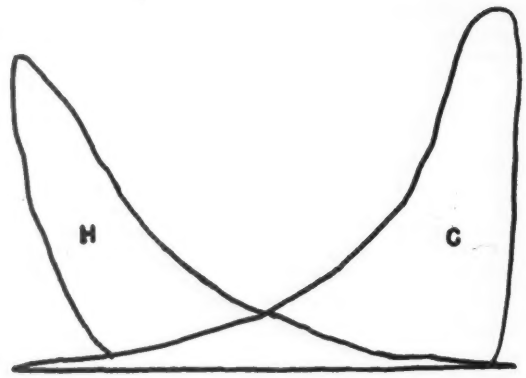


Fig. 1. Ed's engine, installed second hand, gave a card like this, and all efforts to improve it failed. The engine is a 15 by 20 in. vertical Fitchburg operating at 135 r.p.m. Figs. 1, 2 and 3 are reproduced full size and were all taken with a 40 lb. spring. (The back pressure for all three is 7 lb.) Steam pressure for Figs. 1 and 3, 90 psi., for Fig. 2, 95 psi.

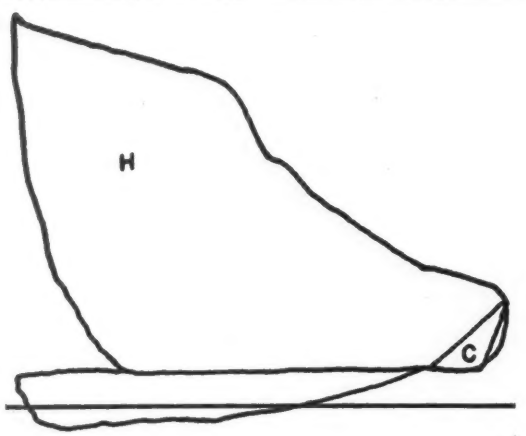


Fig. 2. This spring the engine stopped. Eventually it was started again but the card looked like this! On p. 95 of the August issue Mac said it looked like a fake, Ed said no it was the real thing but the crank end valve had worked loose

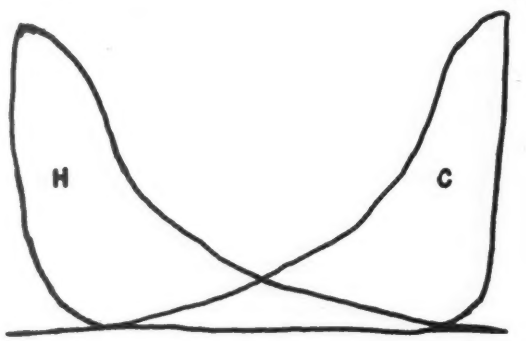


Fig. 3. After tightening the valve and doing a complete job of valve setting, the card now looks like this

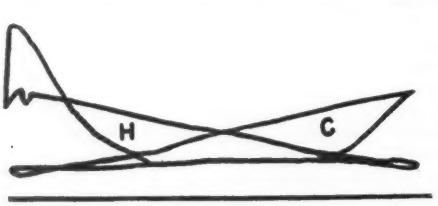


Fig. 4. For those who prefer a cockeyed indicator card to a crossword puzzle for recreation, Ed offers this one, taken from a 10 by 12 single engine operating at 142 lb. pressure, 7 lb. back pressure. The card is reproduced full size and was taken with a 40 lb. spring

located new centers, reset the valves and that gave us the Fig. 3 card.

For further comment and analysis I am also sending a card taken from a vertical slide valve engine, size 10 by 12 running at 142 r.p.m. This was taken with a 40 lb. spring, 90 lb. steam pressure, 7 lb. back pressure.

Chicopee, Mass. ED POMEROY

A PLANIMETER substantiates Ed's claims and the original statement that "the engine is running fine in spite of the appearance of the card." In Fig. 1 the head end and crank end, m.e.p. is 17.5 and 21.5 psi. respectively; in Fig. 3 they are 22 each; while in Fig. 2 the head end m.e.p. is 49 and the crank end minus 5 giving a net of 44, double the m.e.p. of either end in Figs. 1 and 3.

Ed's reference to the Editor is in connection with the original reply to his question. In part this is: ". . . It is quite evident from the cards, of course, that the head end is doing all the work and that the crank end is acting as a brake. As a matter of fact, it appears as though the steam valve from the crank end was not opening at all. Offhand we would say that the valve rod is broken, or loose, so that the valve is not moving or else, a remote possibility, that the steam port is completely blocked up . . . At the first opportunity it would be advisable to open up the steam chest, take a look at the crank end steam valve and then reset the valves completely according to the attached directions."

Directions for Setting the Governor and Valves of a Fitchburg Engine

Put the governor upon the shaft, leaving it loose enough to roll without moving the shaft. The location of the governor case is determined by placing engine on one dead center and rolling the case around the shaft till the offset of the eccentric is on the opposite side of the shaft from the crank pin. Then roll carefully into such a position that when (with the springs removed), the eccentric is thrown back and forth across the shaft, no end motion is given the valve rod.

At this place tighten the governor case firmly upon the shaft and roll the shaft to the opposite dead center, and again move the eccentric back and forth across the shaft. If there is, at this end, any end motion to the valve rod change the position of the governor case on the shaft enough to make the motion just half as much, then fasten the governor case firmly

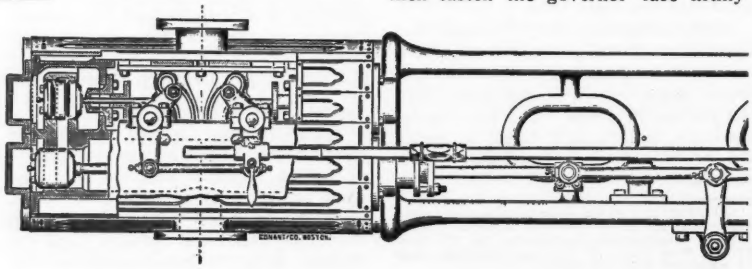


Fig. 5. Valve motion and cam wrist plate as used on the Fitchburg engine. This and Fig. 6. are for horizontal engines because adequate detailed illustrations of vertical engines are not available. Both types of engines are double eccentric

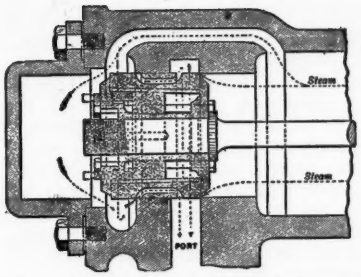


Fig. 6. Details of the double ported expansion steam valve used by the Fitchburg engine. Expansion refers to the valve construction and wedge shape adjustment by what the valve may be expanded to reduce the clearance

in the final position by drilling into the shaft for the point of the set screw. Then tightening the clamp bolts to place solidly.

Put in the springs and tighten them until the proper number of revolutions is obtained. Be sure to tighten up the springs that go through the counterbalance. This hangs nearest the springs (when governor is at rest) about ¾ in. more than the springs on the other side. Adding to the centrifugal weight arms and increasing the tension of the springs makes the governor more sensitive. Do not however make radical changes in weights or springs.

Travel of the exhaust valves can first be evened up, before their eccentric is tightened upon shaft, by rolling the eccentric around the shaft to its extreme throw at each end. It should then be set so that the port is just closed when the crosshead has traveled a little less than 7/8 of its stroke. Then anchor firmly upon the shaft with the set screw.

To adjust the steam valves, place the latch of the hook in the center of the half-spiral slot and clamp the hook firmly by its lever. Even up the movement of the wrist cranks by the right and left hand nut in the valve rod, so that in a revolution of the engine shaft they rock evenly each side of a vertical line drawn from centers of their shafts. Set the engine exactly on the head center and move the small valve rod attached to the head valve in or out of its cam until the port is opened the proper lead. In usual cases this will be about 1/16 in., then tighten the set screw, in neck of cam, upon the rod firmly.

Roll engine to opposite center and set the other valve in the same way. After the valves are thus set as closely as possible, they should, if practicable, be adjusted by use of the indicator when engine is under partial or full load, as no mere measurements can ever set valves exactly right in any engine.

The outer shell or surface of the valve is adjusted to its seat by moving endwise the cone inside it; two tap bolts draw the cone back to loosen, two set screws force it forward to tighten. When valves are adjusted correctly to move easily by hand without looseness, see that bolts and set screws are left tightened firmly against each other thus forming a lock against loosening. Figure 6 explains this clearly. In the larger valves there are four through bolts passing from end to end of the valve to draw the heads firmly upon the outside ring. These have two nuts each at the outer ends.

In adjusting the valve the two tap bolts bearing upon head must be loosened up, then the nuts upon the four through bolts loosened a very little, perhaps 1/16 of a turn only (and each one the same) and the two set screws screwed down. If there is not enough expansion repeat the operation until valves are just right. Then screw home the tap bolts and tighten securely the nuts upon the through bolts.

In the smaller engines the valve heads are drawn down by the collar nuts upon the rod, and these can be loosened very slightly in place of the through bolts. They should be tightened very firmly at last with the special wrench furnished for the purpose. A little experience will make this easy, and it should be done in 6 or 8 mo. after the engine is first started. After this every 12 mo. will be enough.

On the hook, the thumb-latch is to locate the hook on the rod, not to drive the rod, this must be done by clamping hook to rod with the right and left threaded handle below the hook. Be sure the nuts on the threads of this handle are adjusted to keep the handle in the center of the slot and also to allow gripping tight when the handle is drawn up.

Geo. Has the Right Idea Tool

HAS ANYONE as yet told E. S. P. that the steam valve on the crank end of his vertical Fitchburg engine does not uncover either of the two ports? Apparently, the valve stem is broken, or the stem nut is off, with the movement of the valve gear sliding the stem up and down through the valve. The work area of the crank end is not caused by the valve admitting steam, but by compression and subsequent expansion of steam exhausted from the head end and admitted to the opposite side of the piston through the crank end exhaust valve.

I say this because it seems impossible for the valve to be so far out on the stem (or for the stem to be so long) that it can still move far enough in reverse after opening the ports so little. The engine runs smoothly, of course, as it is running single-acting, with the crank end practically blocked off. But it cannot have but slightly more than one-half the power it should have, assuming steam and exhaust mains of the proper size.

GEORGE HOLMAN

Answer No. 183

Drying Air by Refrigeration

WAR CONDITIONS have made caustic potash scarce and A. A. E. who has a liquid oxygen plant in Mexico asked on p. 100 of the June issue whether it was practical to dry air by refrigeration in order to save on the use of potash.

Two answers were received dealing primarily with the equipment arrangement. The chart shown by Fig. 2 (reproduced from the article Humidity and Low Temperature by Wallace H. Martin and Earl C. Willey of the Mechanical Engineering Dept., Oregon State Agricultural College, originally appearing on p. 113 of the February, 1937 issue of POWER PLANT ENGINEERING shows the heat content of moist air at various temperatures. The method of using the chart for determining the refrigeration capacity needed for drying to a given degree is explained in the caption.

Here Are the Details with Operating Instructions

HERE is my answer to the question of how to dry air by refrigeration. For simplicity Fig. 1 shows the use of brine as the refrigerant, since it is possible that a cold brine tank may now be in use for other purposes in the plant and which could also be used for supplying brine to the dehydrator. Operate the unit with cocks set as shown on sketch. When the left coil becomes heavily frosted, switch the brine flow to right cylinder coil and reverse the direction of air flow. Now the left cylinder coil will cool the air and defrost at the same time, while the other cylinder coil is frosting to a

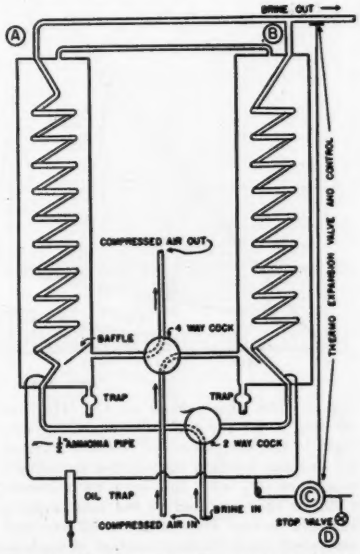


Fig. 1. Equipment and arrangement suggested by Mr. Ray for drying air by refrigeration. One coil is in operation while the other is being defrosted by the incoming warm air

point when the system is reversed again and so on.

If cold brine is not now available, don't install a brine tank but use direct expansion by installing the ½-in. ammonia header in place of the brine header. Install Valves A, B, C, and D and also, a thermo-expansion valve control. Now to start operation as before; open Valve A, close B, and open D with judgment. When the left cylinder coil becomes frosted reverse the air, close Valve A and open B. Close Valve D for approximately 5 min. Gas now stopped at A will in a few minutes push the liquid ammonia into the right cylinder evaporating coil. Then Valve D can be opened. When the right cylinder coil becomes frosted reverse as before.

The air pressure and temperature of the refrigerant will of course determine the degree of dehydration.

West Los Angeles, Cal. REMBERT RAY

Feels an Aftercooler Will Do the Trick

WOULD suggest that A. A. E. install an aftercooler in his system after the air compressor. The aftercooler is practically identical with the intercooler, however, it is important to remember, that it must deal with higher pressures and smaller volumes. The aftercooler should be located as close as possible to the air compressor, and also be provided with a suitable means for draining. The main function of the aftercooler is to reduce the temperature of the compressed air as low as possible to condense the moisture and deliver the air to the line at maximum density and minimum temperature.

Besides its use for withdrawal of moisture, the aftercooler is most effective on the pipe-line efficiency for there is nothing worse about an air-power plant than a leaky system. A badly leaking pipe line will waste much power, and nothing is more conducive to a leaky line as wide extremes of temperature, which produce strains of expansion and contraction.

Without an aftercooler, air will enter a pipe line hot, while the pipe itself is cold; but the latter gradually takes up heat from the air and the heated portion extends along the line the longer the load is on the line and the whole system expands accordingly. Plants that are shut down at night, when the atmosphere is cooler, will show a corresponding contraction all along the line.

Therefore it is difficult to keep joints tight and valves from leaking even where the best possible mechanical precautions are taken along the line. The use of an aftercooler obviates these extremes of temperature, to some extent, and leaves the pipe line subject only to the expansion and contraction consequent upon changes in atmospheric temperature. If A. A. E. can hook up an aftercooler in his system he will be assured of having dry air for the manufacturing of oxygen in a liquefying tower.

MARTIN N. GOZDENOVICH

Fairview, N. J.

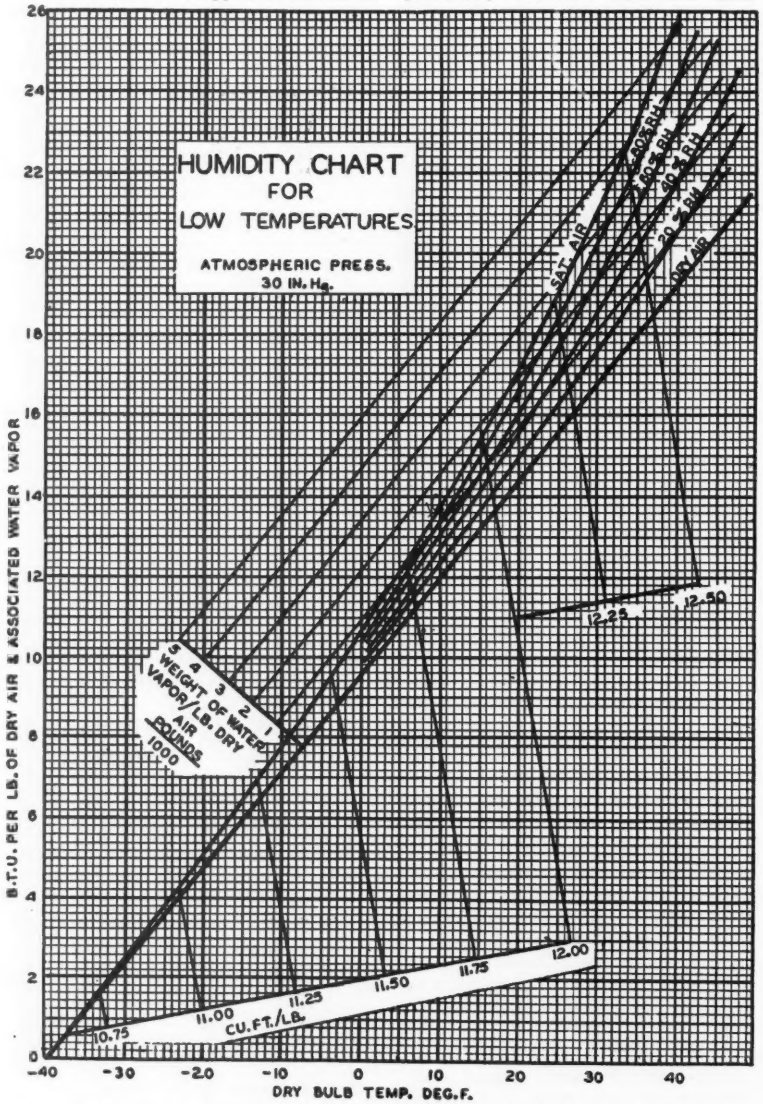


Fig. 2. This chart shows on the left hand vertical scale the heat content above minus 40 deg. F. for dry and moist air. Constant volume lines are shown sloping upward from the right to the left. Constant moisture content lines run from left to right parallel with the dry air line and crossing the relative humidity lines. The water content is given in 0.001 lb. per pound of dry air. This may be converted into grains per cubic foot by the relation: 1 lb. = 7000 gr.; and by the volume per pound read from the constant volume lines. For example to cool 1 lb. of air at 80 per cent relative humidity from 35 deg. F to 20 deg. F. saturated, read the heat content at each point and subtract. Thus 22.2 — 17.1 = 5.1 B.t.u. The specific volume at the first point is 12.55 cu. ft. per lb. so the 1000 c.f.m. would weigh 79.6 lb. This multiplied by 5.1 gives 406 B.t.u. per minute which would have to be removed or just over 2 t. of refrigerating effect. Note that the chart is drawn for atmospheric pressure or for free air. Charts for other pressures can be constructed by the methods as explained in the original article

Answer No. 185

His Exciters Hunt

OPERATING three engine generator sets, 1850, 526 and 150 kv-a. in parallel, W. R. has difficulty with the exciters hunting. On p. 100 of the July issue he asks readers for a possible solution of the problem. One answer to this question appeared on p. 99 of the September issue.

Carl Says It's Probably Speed

ANYONE may cite several reasons which cause an exciter to hunt but the main reason is a variation of speed by the prime mover. This unstable speed may come from steam pressure variations (assuming steam is used to drive the alternator), which has been lowered due to an abnormal demand when a second machine is put into service. Consequently the exciter cannot produce the necessary excitation current for its respective generator.

But there may be an open field or

armature circuit, which must be detected in the customary manner. A shortened armature coil is also instrumental to hunting of exciting machinery.

When testing the field and armature, truing and slotting of commutator is advisable because high mica is a never ending source of trouble. Brushes, which may be too hard or too soft, or, cover too many bars, or seat loosely in their riggings, also contribute to operating difficulties.

Glendale, L. I., N. Y. CARL EGERTER

Letters and Comments

Atomizer John Substitutes Japs for Scale

ATOMIZER JOHN done got himself established in the Army as Fourth Class Private B.V.D. (Best Virtue Down). They done jerked him off as selective service (undesirable class 77 Z). He reported in the nude and they only put shoes on him because they said it wasn't necessary to cover anything else he should have. Of course this was a blow (or two) to Atomizer John for he was essential to a vital war industry. Who else could swell up and follow a 3 in. tube cleaner through a tube, or catch the scale in his teeth by laying them out on the deck. Control yourself, for before this is all over he's going to prove one theory. Whether a Jap or Nazi flop around like a chicken when their head is cut off. Then the moron Atomizer John will return to a normal life chasing B.t.u.'s and tube cleaners. Bear with him, please.

By Atomizer John (Himself)

EDITOR'S NOTE: *Atomizer John, being a modest soul, always writes in the third person so that he can say more things about himself without a twinge of conscience—he just makes believe he is someone else and lets himself go. Many months ago with his first contribution he sent in an autobiography, also in the third person, but with a prominent and heavily underscored note to the effect that it was "Conceived by Atomizer John—dictated by Atomizer John—transcribed by Atomizer John." One would surmise John himself was the author and that the world should know about this shining light being hid days in the Ozarks by a bushel basket. The autobiography follows:*

Atomizer John

ATOMIZER JOHN was born in Missouri some time. His parents were father and mother. He was forced to quit school in the fourth grade when his grandmother was thrown off the football team of a correspondence school. His first fireman's job was carrying scuttles of coal for three old southern maids. He has the distinction of consistently making the highest negative grades on I. Q. tests. He can tell you how to work safely from practical experience for he holds the nation's highest records for lost time accidents.

He can tell you about tube cleaners for dentists use them to drill his teeth. His knowledge of fuels is wonderful (alcohol is a fuel, isn't it?). Well, at least he's burned his tubes out with it. He has had worlds of experience with bricks because he's pounded them all his life looking for a job. Atomizer John excels with his knowledge of burners, especially trash burners, for that's where he gets most of his clothes.

He's a schoolmate of Pulverizer Pete's, for they went to different schools together. Pulverizer Pete is the Intellectual Giant, Atomizer John is the Ignorant Giant.

The Chinee Is A Rank Amateur

BRETT HARTE observed that "for ways that are dark, and tricks that are vain, the heathen Chinee is peculiar". Of course we have no objection to Harte's interpretation of Oriental psychology, but we do think that if Mr. Harte had been given an opportunity to acquire some present day experience with that psychic and inexplicable human, the Personnel Manager, he would not have cited the comparatively simple Chinese for dark ways and vain tricks.

Although the wiley Oriental may conceal divers cards in his ample sleeves, at least he WILL show his hand, but our gentle P.M. only retires quietly behind his barricade of red tape and shining mahogany bastion.

When, in the hope of obtaining a position of sorts, you approach Mr. P.M., he fixes upon you a glittering optic, and while you prepare yourself for a barrage of questions bearing upon the more intricate and practical phases of your work, he is preparing a procedure to knock you off your feet.

You lay before him letters and recommendations showing, perhaps, several decades of varied engineering experience, and he queries profoundly, "How are tubes fastened in the sheet?" Before you can recover balance, he wants to know, "Can you tell good coal from bad, from the analysis?"

Your hasty reply that there is more to coal than meets the eye is carelessly brushed aside, with the implication that, if you knew anything you would answer Yes, or No. A few minutes of this, and you are groggy, your mind wanders under the spell of that hypnotic eye, as you claim that, Yes, you could operate a 10,000-kw. rig. No, 7500 has been your limit so far. Well, you think the principle is the same. Oh? You Do!

By this time you realize the error of your ways; you realize that years have been spent in vain, and you retire shamelessly from the battlefield. Outside, you grasp your head, bloody but unbowed and remembering Henley, you thank God for your unconquerable soul, of which you hope you are the captain. All the while, your stern practical training assures you that all this will not obtain groceries and next day you find that the Boss' son got the job.

SAM WILLIAMS.

Diesel Power In A Small Factory

AN ARTICLE on p. 62 of the August 1942 issue of POWER PLANT ENGINEERING concerning the cost of Diesel Power in the plant of the Geyer Mfg. Co. at Rock Falls, Ill., has been read with much interest. It would be interesting, however, to know the cost of installing this engine together with the usual fixed charges such as interest, depreciation, etc. Also I should think that it would be desirable to add the fixed charges to the actual operating costs in order to arrive at the actual cost per kw-hr.

Consulting Engineer. L. A. DAY

St. Louis, Mo.

Cost $14,000, Says the Author

MR. DAY asks some very fair questions about Geyer operating costs. I was reluctant to use the Geyer Co.'s figures on depreciation because they are depreciating on a 10 yr. basis which is inordinately fast for a Diesel plant. Instead I used a device quite common in the industry of calculating the length of time it would take for savings to pay the cost of the plant. In many respects this figure has more reality than the uncertain concept of plant depreciation.

To fill out the information for Mr. Day, the Geyer plant cost $14,000. The company had been paying 2.5c per kw. hr. purchased power. Subtracting actual operating expenses as detailed in the article, the savings would pay the initial cost in about 5 yr. and the operating costs thereafter could be considered as complete with considerations of interest and depreciation wiped out.

Mr. Day might be interested in the system adopted by the Rural Electrification Administration with regard to depreciation of R.E.A. Diesel plants. They deduct all maintenance costs from the depreciation charge on the theory that adequate maintenance and repair tends to nullify the depreciation of a Diesel.

WILLIAM H. GOTTLIEB

New York, N. Y.

How To Make Thermometers And Control Instruments Last Longer

By E. F. NORDSTROM, Mgr.
American Shaeffer & Budenberg Instrument Div.
Manning, Maxwell & Moore, Inc.

MAINTENANCE equipment at present is difficult to obtain, and frequently delivery on replacements takes a long time, so in order to make your thermometers and control instruments last longer, special care must be practiced. Following is some timely advice as to proper care and maintenance of this equipment.

Control and Recording Instruments

Put all the instruments in charge of one man. Have him wind the clocks, change the charts, and ink the pens, and also have him keep them clean.

Check the installations and if necessary change locations to some place away from excessive heat, fumes or vibration. Be sure to fasten any loose or dangling tubing against permanent beams or posts to avoid damage.

Covers or hoods should be placed over any instruments exposed to the weather. Also place covers over any instruments exposed to moisture from water or steam hose.

Write for Operating Information

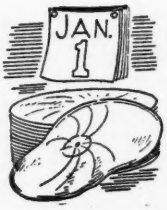
Do not allow anyone except the instrument men to move an instrument from one location to another, and have the instrument man write to all instrument companies for complete sets of operating instructions for each instrument in the plant.

Locations of instruments should be checked and if necessary remounted in places more accessible to observers. Where the tubing runs near the floor, either fasten it to some solid object out of the way of traffic or build a housing over it.

When checking thermometer readings, be sure to agitate the water or oil in the checking pot; be sure to wait long enough for the thermometer being checked to come to its reading and make sure your test thermometer is accurate, and above all, have the test made only by the man in charge of instruments.

Charts

Charts should always be stored in a cool, dry place. Do not leave them lying on steam pipes or in rooms where there is moisture present, or where they can become dirty. Also keep charts in their original packages, and keep them lying flat.



It is advisable to purchase at least one year's supply of charts at a time for each instrument. It saves paper work, and besides there is a quantity discount for chart sales.

Glass Thermometers

Glass thermometers should be handled only by men who have been taught they can be broken easily. If the tube of a metal enclosed glass thermometer becomes dirty, carefully remove the front frame of the thermometer and wipe off the tube and scale with a damp cloth. Do not use gritty soap.

When long stem thermometers are not in use, have a place to hang them up and hang them there. Do not lean them against walls, boxes, posts, wheelbarrows, or barrels. Make sure they are hung up.

Careless Handling

More instruments are damaged by careless handling than by any other cause. Removal of that cause assures a longer life, better service, and lower cost for all instruments.

Photo in Nalco plant, Chicago

Over 4000 power plants using the Nalco System testify to its superiority. Nearly every one can tell you of results far beyond their expectations.

Feedwater treatment scientifically developed to meet the most difficult requirements is the only answer to maximum efficiency. The exclusive goal of the entire Nalco organization is to provide the finest industrial water treatment methods and chemicals available. It will pay you well to let this organization work for you.

THE COMPLETE WATER TREATING SERVICE*

Nalco

NATIONAL ALUMINATE CORPORATION, 6224 W. 66th Place, Chicago, Ill.

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

PROPER CARE OF RUBBER BELTS

To make your rubber belting last longer and do more, adhere to the following rules

Prepared by the Manhattan Rubber Mfg. Div.
Raybestos-Manhattan, Inc.

GENERAL RULES

Do not allow oil, grease or gasoline to come in contact with belt.

Avoid exposing belts to sunlight and excessively hot or cold weather.

Too small pulleys shorten belt life.

Provide take-up facilities.

Avoid heavy overloads of all kinds.

Don't leave tools or other objects near belt to get caught in drive.

Avoid abrasion on nearby objects.

Consult your Manhattan service man. Write factory or your distributor.

TRANSMISSION BELTS

Use right size and type of belt on pulleys of correct size. Do not try to take out all stretch on installation, but have only tight enough to pull load without slipping—then shorten only if necessary.

Use proper type fasteners and of the correct size for the pulleys.

Keep tight side down for greater arc of contact and more power.

Do not apply large belts by rope and power.

Use constant tension motor base on short center drives.

Cut belt square and line up before splicing. Seam side away from pulleys.

Keep pulleys clean, in good condition and in correct alignment so that belts will run true and wear evenly.

Keep proper tension. A belt that is too tight may cause fastener and bearing trouble. If too loose, may slip and wear.

If dressing is necessary use type recommended by belt manufacturer.. Never use rosin. Correct fault in drive instead of dressing belt.

Pulleys with excessive crown cause fastener failure.

Inspect splices and remove worn fasteners before causing breakage.

Don't allow belt to rub against stationary objects.

Avoid slippage, evidenced by polished surface.

Use factory made endless belts whenever possible. Cut down large worn belts into smaller sizes for light drives.

V-BELTS

Do not force belts onto sheave with instruments of any kind. Slack off on take-up and place belts into grooves.

Work belts around grooves until all of the slack is on ONE SIDE OF THE DRIVE, then tighten take-up until belts are fairly snug.

Before starting check pulley alignment, check bearings for oil and see that drive is clear and free. Adjust take-up so that when drive is operating at full load and full speed, only a slight bow appears on slack side. Vertical drives, extremely short center drives, and drives carrying pulsating loads must be operated tighter than others.

Use sufficient number of correct sized belts to handle maximum load. Be sure sheaves are over accepted minimum diameters.

Design new drive to take standard belt and sheave sizes. Belts must not bottom in grooves. Bottoming causes belt-destroying heat from slip.

Do not use belt dressing. If belts slip, clean with cloth dampened in gasoline and tighten drive slightly.

See that sheave grooves are free from burs and extreme wear. Replace worn sheaves and check alignment periodically.

On failure of first belt on a drive, replace entire set with new belts, keeping worn belts as spares for subsequent failures.

Store belts uncoiled and hung over forms on rack or wall in a cool, dark place.

CONVEYOR BELTS

Make sure idlers are in good condition, turn freely and are lubricated so that oil and grease will not get on belt.

Avoid long feeding drops for heavy materials. Install retarding devices or redesign feeding chutes.

Load evenly and centrally to distribute wear over entire surface. Irregular, uneven or heavy loading causes spillage, also tends to make belt run crooked.

Hard pieces of material passing between tail pulley and belt will damage belt. Install tight decking over return belt, especially at feed point.

Don't overload and on the other hand don't overspeed conveyor. Regulate speed of belt to prevent cover wear.

Don't stop belt under load. Load to capacity.

Use flexible skirt strips of rubber without fabric. Don't use guide idlers. Crooked running belts should be cut and accurately respliced, idlers aligned, and the feed made central.

Use lagging on drive pulley to reduce belt tension.

Slide, don't drop material on belt, and through a notched opening, or use coarse screen or grating in chute so that the fines will cushion the lumps. Don't let edge of chute touch belt.

Keep belts and pulleys clean.

Keep end pulleys and idlers in alignment to prevent belts running crooked.

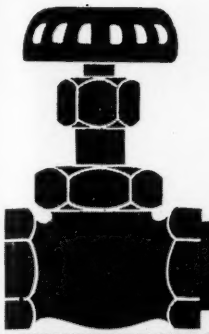
House belts to protect them from sunlight, excessive heat, cold and moisture, and to make repairs and inspections easier.

Inspect belts and idlers regularly and make necessary belt and splice repairs promptly. Keep belt tension low.

On belts under high tension use vulcanized field splices.

When metal fasteners are used select correct size for the end pulleys.

Gravity take-ups, mechanical feeders, large end pulleys and careful inspection and maintenance prolong the life of conveyor belts.



A Time-Saving Valve FOR THOSE ALL-IMPORTANT PRODUCTION LINES

In these critical times when uninterrupted production is all-important, every minute saved in maintenance means more productive hours.

Lunkenheimer "N-M-D" (non-metallic disc) Valves cut maintenance time to the bone, because it's only a matter of minutes to renew a worn disc and keep the valve on the job.

Users of Lunkenheimer Valves are profiting from their wise policy of buying highest quality. They are getting continual tangible evidence of what really good valve performance means in dependable and low-cost service.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" Allocation Classification Symbols on their orders. This will be of mutual helpfulness.

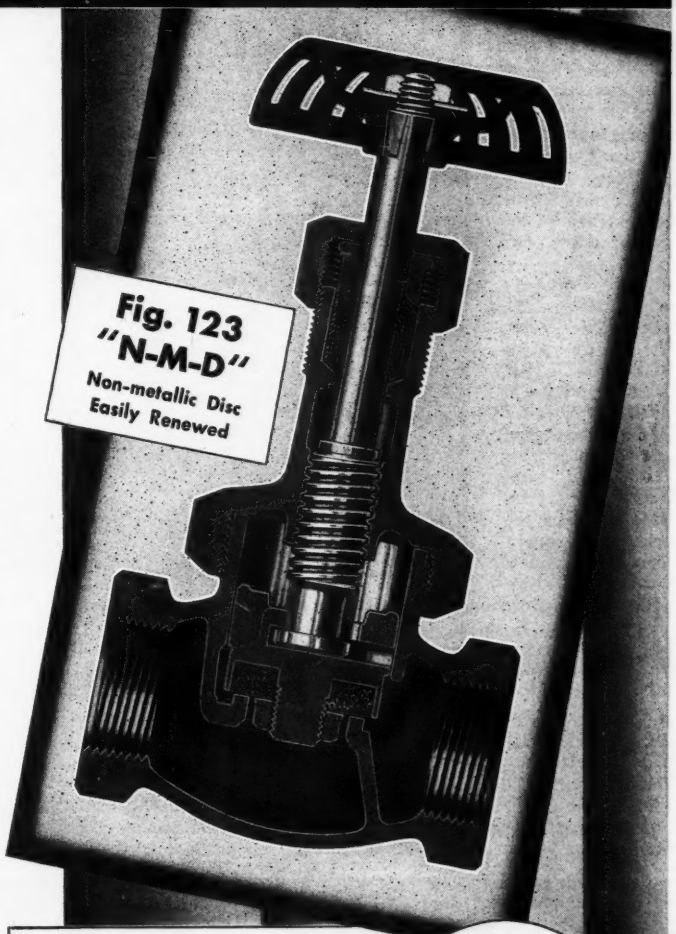
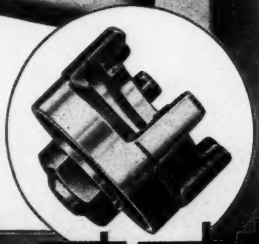


Fig. 123
"N-M-D"
Non-metallic Disc
Easily Renewed

With a few spare disc holders complete with discs on hand, the time required for renewing can be cut to almost nothing.



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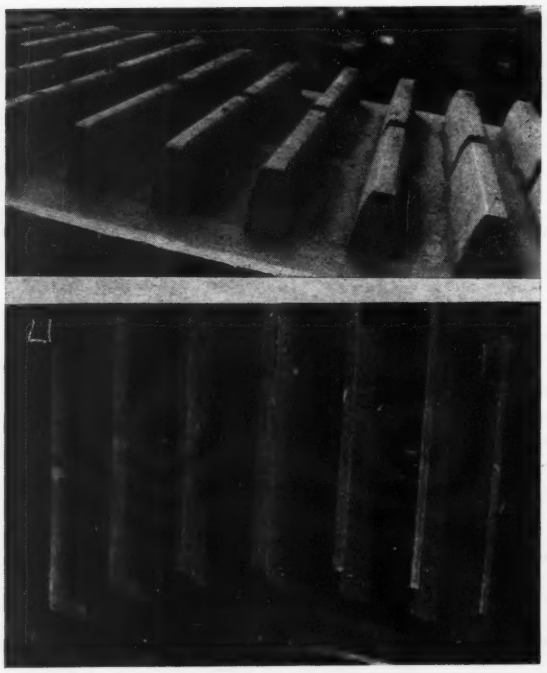
NEW YORK CHICAGO
BOSTON PHILADELPHIA
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

LUNKENHEIMER VALVES

SHOP TALK

A department showing by means of photographs how engineers in various plants have overcome certain obstacles or devised methods to facilitate operation. If you have done something along similar lines that you are proud of or which you feel may be of interest to others, send us a picture and a paragraph of explanation. If the photograph is good and if the idea is original we will present it on this page and pay you for it.



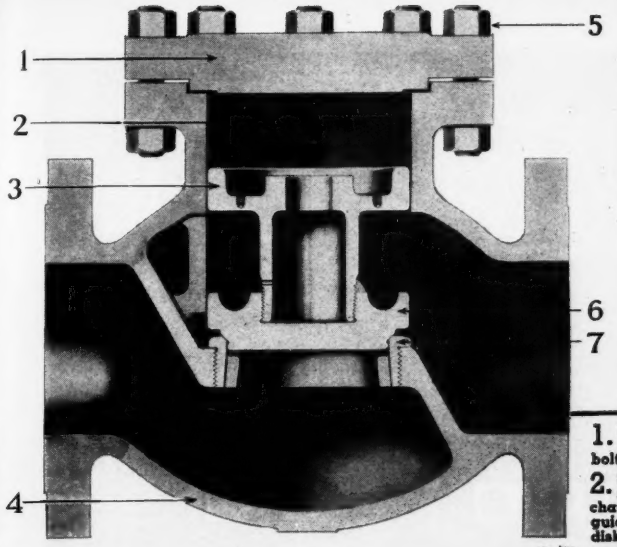
WOODEN GEARS. Few of the maple cog gears, so widely used years ago in small hydro plants, are rapidly disappearing. The accompanying photographs show the wooden crown gear cogs (above) and a cast iron pinion (below) recently taken out of service by Elmer Reuther, superintendent of the Moline Water Power Co. plant at Moline, Ill. (see p. 62, January, 1942 issue). A set of maple cogs give about 9 yr. service with good care. From time to time they must be trued up using a template and a carpenter's slick (chisel to you). Ridges visible in the photograph at root of the teeth show a wear of about ⅜ in. Cast iron pinions outlast two or three sets of cogs. The one shown has worn about ¼ in. at the side of the tooth and the top wear can be estimated from the ridge in the center. Lubrication is important but simple—oil applied with a brush or swab once a day fulfills the lubricating operation.

PULVERIZER PROTECTION. Rags, wood and tramp iron are kept out of the pulverizers at the Lake Springfield municipal plant at Springfield, Ill., by these screens welded from bar stock. They do not interfere with the operator's view of the coal feed from the hopper to the feeder but do effectively stop foreign materials large enough to interfere with the feeder or pulverizer. The screens are removable and the foreign materials are dumped periodically.

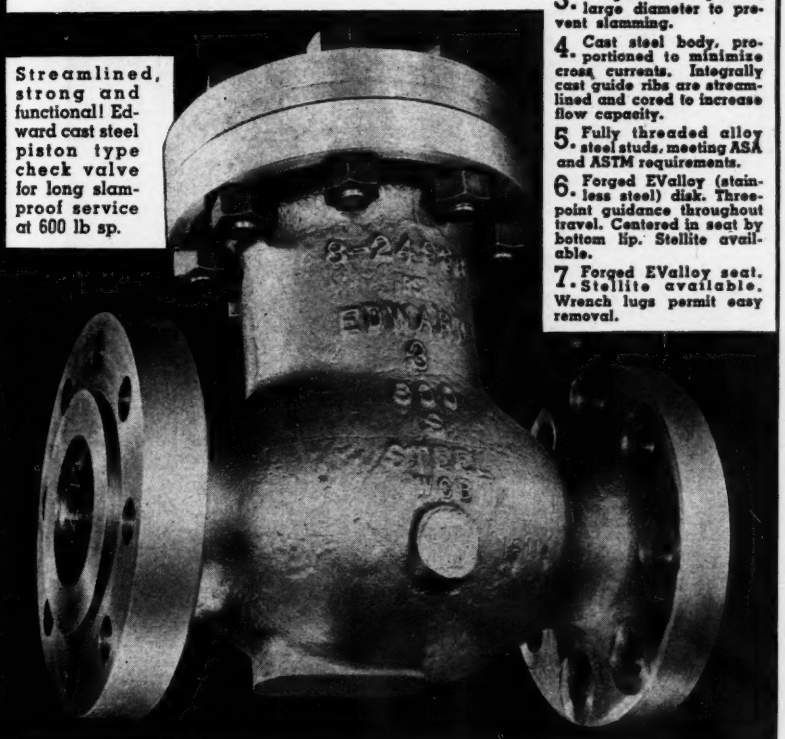
TURBINE HALF SOLES. Edges of large turbine blades are subject to severe corrosion which, if unattended, impairs efficiency, and, in extreme cases, may lead to blade breakage. In this photograph a welder is adding Stellite facing strips to pitted turbine blades at the Richmond Generating Station of the Philadelphia Electric Co. Above the torch are the finished blades, below the pitted blades cleaned and ready for the facing process.

DRYING PRINTS. Production of Van Dykes was speeded up 350 per cent, and the number of rejected prints was reduced from 25 per cent to zero, a savings of approximately $300 per mo. at the Westinghouse East Pittsburgh works. Under the old method, drying time was 10 min. and squeegeeing often distorted the scale drawings to such an extent that they had to be scrapped. Fidelity reproduction and reduced drying time is now attained by using a bank of twelve 250-w. infrared lamps, to replace the steel roller and drying unit. Van Dykes up to 102 by 36 in. are hung beneath lamps strung in three rows 9 in. apart. The four lamps in each row are spaced every 2 ft. Drying time for the average (24 by 36 in.) size print is 3 min. instead of 10 and there is no distortion.

CUT SHOCK, SLAM and CLATTER with EDWARD *Piston Type* Check Valves



1. Forged steel cover, through bolted to body.
2. Smooth, self scouring piston chamber for accurate guiding of piston-disk assembly.
3. Forged steel piston, large diameter to prevent slamming.
4. Cast steel body, proportioned to minimize cross currents. Integrally cast guide ribs are streamlined and cored to increase flow capacity.
5. Fully threaded alloy steel studs, meeting ASA and ASTM requirements.
6. Forged EValloy (stainless steel) disk. Three-point guidance throughout travel. Centered in seat by bottom lip. Stellite available.
7. Forged EValloy seat. Stellite available. Wrench lugs permit easy removal.



Streamlined, strong and functional! Edward cast steel piston type check valve for long slam-proof service at 600 lb sp.

VIBRATION, clatter and damaging shock to piping are cut to a minimum with Edward piston type check valves.

Cast steel in sizes above 2 in., forged steel in the smaller sizes, they all incorporate exclusively Edward design features that cushion disk action and yet give fast, sure closure.

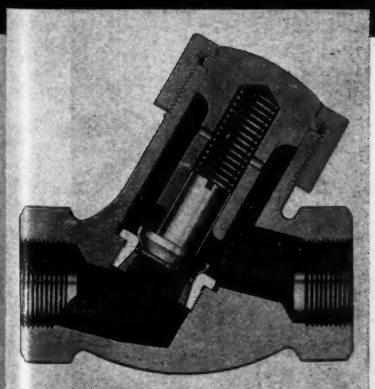
In the cast steel horizontal and angle series, an "hour glass" disk-piston assembly moves in a mirror smooth body piston chamber, guided throughout travel by three streamlined ribs, integrally cast with the body. Thus, kept in proper position to enter the seat at all times, there is no danger of the disk "hanging up."

Correct clearance between piston and dashpot, and large piston diameter effectively dampen disk action during sudden flow reversal. Full area streamlined bodies give maximum freedom for flow.

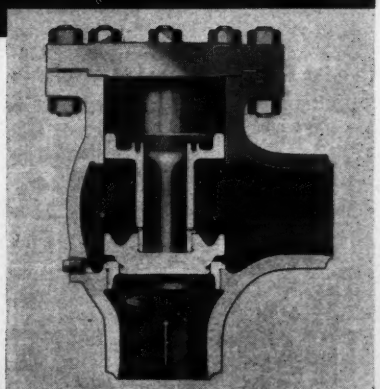
The same principles are used in the design of Edward forged steel check valves, except that in some series a spring is used to aid seating.

For descriptions and dimensions, write for Edward Better Valves Catalog No. 101.

THE EDWARD VALVE & MFG. CO., INC.
220 WEST 144TH STREET
EAST CHICAGO, INDIANA

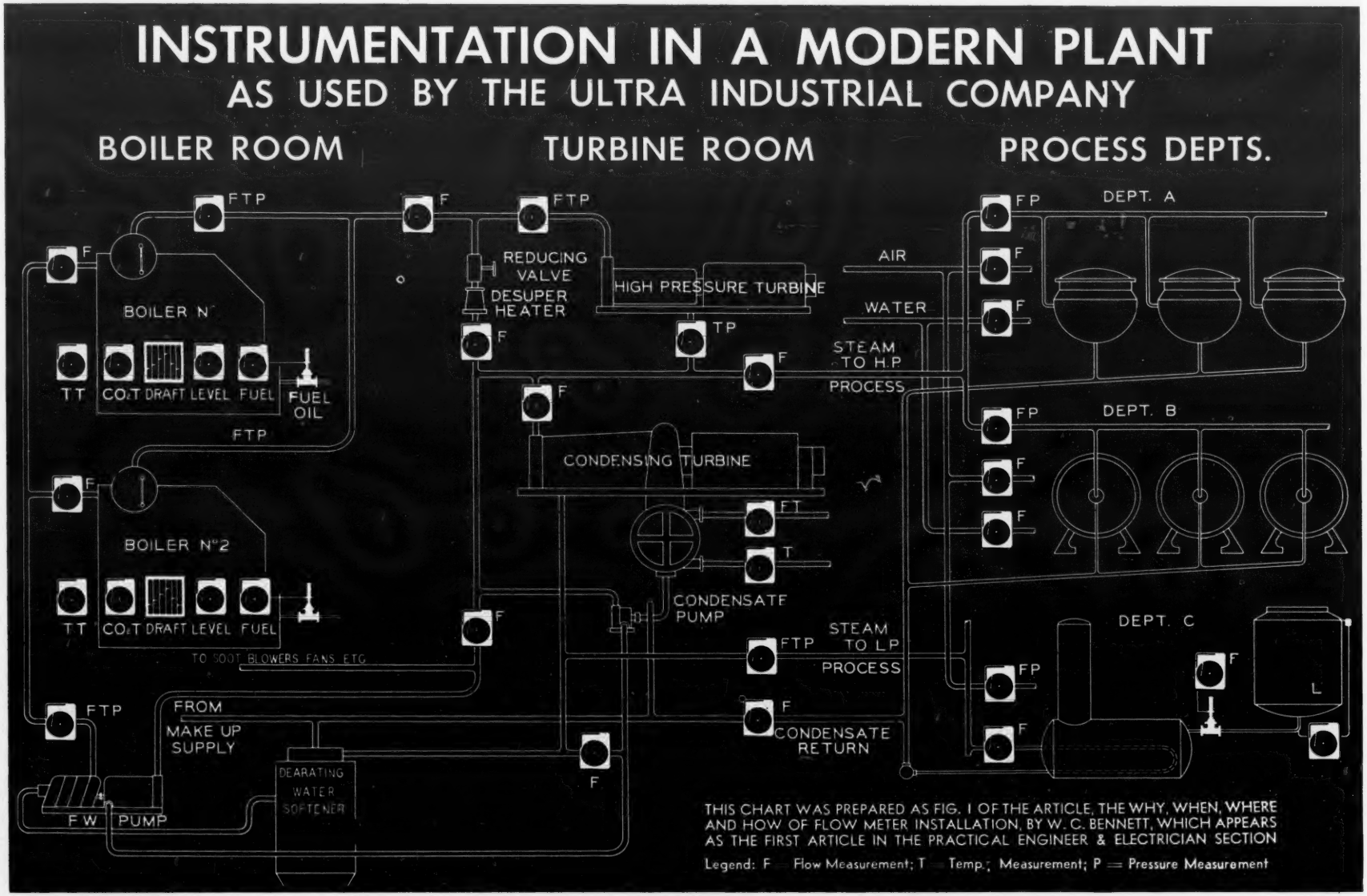


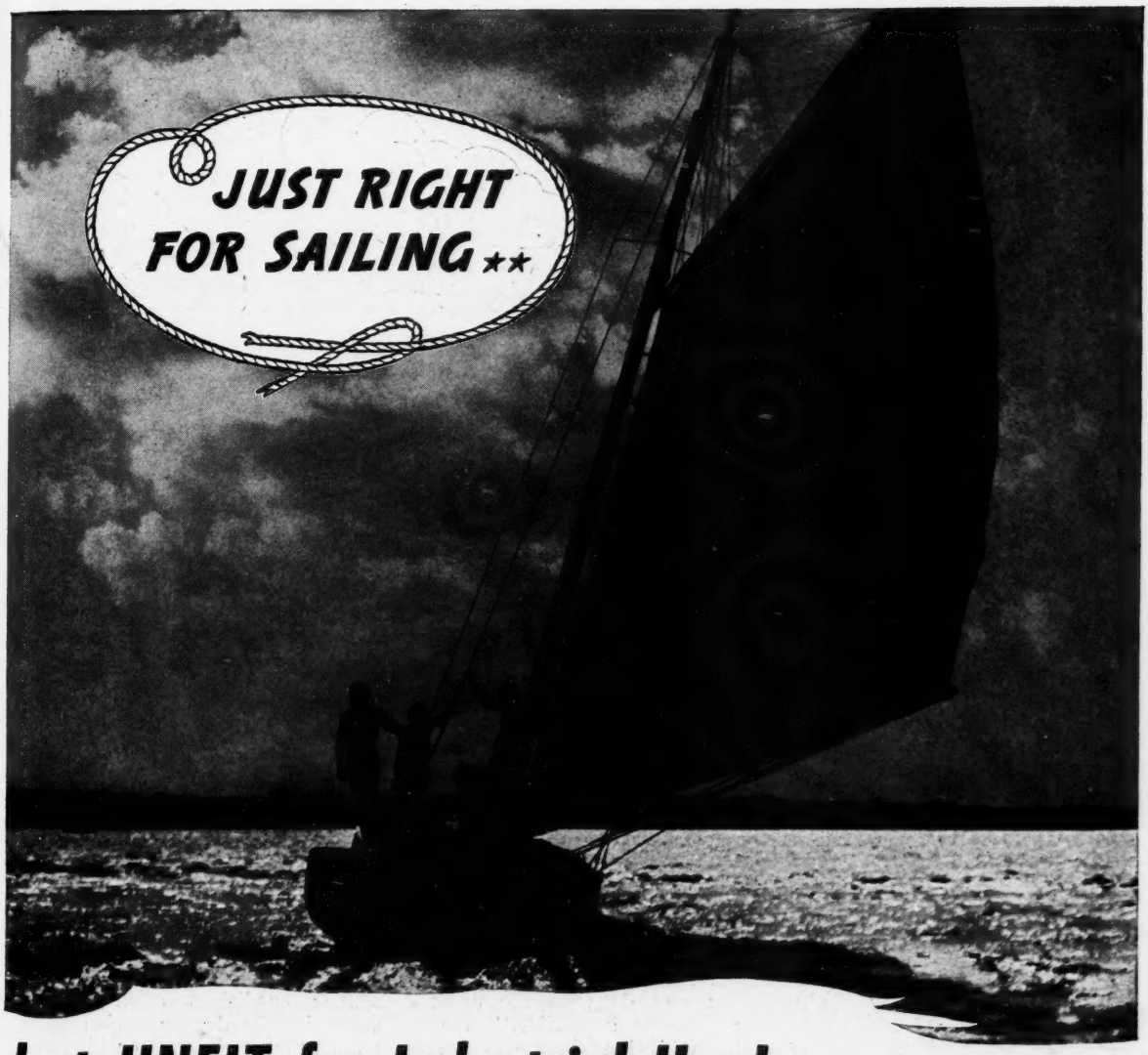
Edward screwed end forged steel check valves, in sizes ¼ to 2 in., give same freedom from excessive vibration as larger Edward check valves. Spring loaded forged steel checks may be installed in horizontal or vertical lines. For 150 to 6000 lb.



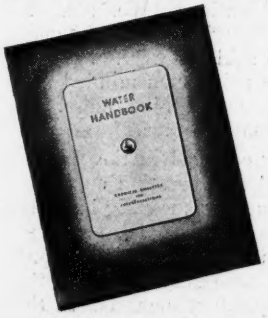
Edward angle check construction is illustrated by 900 lb sp valve above, which has bevel welding ends. Socket or bevel welding ends are available, as well as flanged ends. Integral Stellite seats, and Stellite disks can be furnished, too.

EDWARD *Steel* CAST AND FORGED **VALVES**


INSTRUMENTATION IN A MODERN PLANT
AS USED BY THE ULTRA INDUSTRIAL COMPANY
BOILER ROOM
TURBINE ROOM
PROCESS DEPTS.
FTP
F
FTP
REDUCING VALVE
DESUPER HEATER
HIGH PRESSURE TURBINE
AIR
WATER
STEAM TO H.P. PROCESS
FP
DEPT. A
BOILER N°1
TT
CO2 T DRAFT LEVEL FUEL
FUEL OIL
TP
CONDENSING TURBINE
FT
T
DEPT. B
BOILER N°2
CONDENSATE PUMP
STEAM TO L.P. PROCESS
DEPT. C
TO SOOT BLOWERS FANS ETC
FROM MAKE UP SUPPLY
DEARATING WATER SOFTENER
F W PUMP
CONDENSATE RETURN
L
THIS CHART WAS PREPARED AS FIG. 1 OF THE ARTICLE, THE WHY, WHEN, WHERE AND HOW OF FLOW METER INSTALLATION, BY W. C. BENNETT, WHICH APPEARS AS THE FIRST ARTICLE IN THE PRACTICAL ENGINEER & ELECTRICIAN SECTION
Legend: F = Flow Measurement; T = Temp. Measurement; P = Pressure Measurement



but UNFIT for Industrial Use!



WATER HANDBOOK—*complete treatise on water treatment, containing methods of analysis and interpretations of results for plant control—Price 50 cents.*

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NATURAL HUMIDITY CONTROL

By F. S. GRAHAM

IN PREPARING this article for the public, it is my desire to describe a very effective method of humidity control for refrigerators —a method using simple fundamental laws of nature. I will try to make it as plain as possible so that it may easily be understood by all. I will ask that you read it with an open mind for it is contradictory to the teachings of the experts, at least in parts. There are some who probably will condemn it without trial and there are legions who will benefit by its use. Regardless of the snap judgment of the experts, I wish to say that what follows is the result of actual installations and operations which prove that the means of control used in this system will provide any desired condition needed for various kinds of material storage.

At a dinner, at an engineering club in one of our industrial cities, the speaker of the evening was a very prominent engineer who was in charge of research for a large corporation. One of the things he said was something like this: "We have a large number of engineers in our laboratories who are experts and they know it. They know what to do, what can be done, what cannot be done and the why of everything. We need them, of course, but the men we really are interested in are the fools who come along and do what the experts know to be impossible." I was later told that there was not a single expert in that organization the next day. It has also been said that the greater percentage of new things are stumbled upon and then perfected by science. An old medical doctor once told me that practically all men and especially professional men get set in their ways of thinking at a surprisingly early age. He said, "Take me for an example. I lay the cause of most of the sickness of men to the kidneys and liver and treat them accordingly. Others pick on the stomach, heart, lungs, etc., and base their treatments from these points. It is unfortunate that all men can not have open minds. How much faster we would all progress." Looking at ourselves in the refrigeration field we will find similar conditions exist. Some swear by the dry expansion system and others by float on high or low side, some by full-flooded or semi-flooded, some possibly by various combinations. We, too, are set in our thoughts just as the good old doctor said we were. Perhaps if we were more open minded and would use our brains more, we would accomplish more.

Having engaged in the field of commercial refrigeration engineering for some years the big bugaboo I encountered was constant criticism from the equipment users. This was especially true of the meat and produce markets. In the summer they would cry, "It dries everything up," and in the winter, "Everything is slimy." Here was found an ever growing source of complaints even though the mechanical refrigeration equipment was far better than ice in some ways. It had been oversold to the point that the user expected perfection. They did not stop to think that they had only purchased an

The author of this article, as you will learn when you read it, is a deciple of nature—he believes that we can all learn a few things from nature. You can not, he says, do things contrary to nature and expect to get away with it. You cannot pass warm air over a cold surface without dropping moisture; neither can you blow dry air over a wet surface without picking up moisture. These facts being so, he wonders why, with all the trouble dehydration has caused in refrigeration, we have consistently ignored them so long. As a consequence of his own experiences with the problem of dehydration, he finally took a tip from nature and devised a system of humidity control that really works. This system, he patented, but now, after many disappointments in his attempts to market it commercially, he has decided to release his ideas to the public through the medium of these pages. In this article and the one to follow he describes the entire development of this system of humidity control and gives detailed instructions for applying it in a variety of ways. The system is applicable to any type of refrigerator whether it be a small one of the domestic type of a large one for a warehouse. Whether you are concerned with refrigeration or not, you will find this article interesting and informative

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- Typical Expansion Loops (pictures)
- *Expansion Loop Chart and how Used
- Cold Springing
- *The Flow of Fluids
- Viscosity Conversion Chart
- Pressure Loss Chart
- *Flow of Flashing Mixtures
- *Steam Flow Through Pipes
- Properties of Pipe
- Dimension Tolerances for Welding Fittings and Flanges
- Pressure Ratings for Flanges
- Physical and Chemical Requirements for Flanges
- Pump Capacities
- Hardness Conversion Table
- Gas Density
- Table for Gauging Horizontal and Cylindrical Tanks
- Conversion Tables
- List of Welding Symbols, Material Color Code, Labeling Abbreviations

* This data was compiled exclusively for Tube Turns and is presented for the first time in Tube-Turn Catalog No. 111.

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equivalent to a piece of ice that never melted—a piece that would not constantly have to be replaced. On one installation, where the purchaser was constantly calling for service and where the service mechanics claimed it was operating perfect, I found that everything was in perfect shape, mechanically, but he was experiencing heavy loss from dehydration. He said, "The salesman promised me the Washington Monument and I want it delivered here to me. I want perfect conditions the year around." Needless to say he never got what he expected and finally gave up in disgust. The sales company spent more than their profits in trying to satisfy him, yet never were able to deliver the conditions as sold. This is only one of the thousands of similar instances which constitute a constant source of expense to the equipment sales companies. In fact many merchants have had service losses so great that they were forced to discontinue handling refrigeration. In this it must be understood that we are speaking of commercial installations for the butcher, baker, florist, grocer and similar establishments.

In some installations we had better results than others and yet far from perfect conditions. What the reason for this was, no one knew. We had been trying to correct these conditions by mechanical means some of which were elaborate and worked to some extent during part of the year. However, when the seasons changed, we were worse off than we had been before with serious opposite conditions. We had either far dryer, or far more condensation. On actual test I have found as high as 15 per cent loss to the merchant on dehydration of fresh cut meats. On other tests the loss was about as much from trimming off slimy parts. Practically all installations had one of these conditions at some time of the year.

Thoughts of these conditions held our attention even in leisure hours. On an excursion boat ride up the Hudson River one midsummer day in 1928, I was sitting on the fore deck enjoying the scenery as we steamed up the river. A large violent thunder storm came rolling out of the west, passing ahead of us. It was a magnificent sight although it was spreading destruction in its path. I sat there watching the clouds roll up high on its front with no rain falling under them and then somewhat further back a regular downpour of rain fell that proved later to have been a cloudburst. While watching this I remembered what an old professor at school once had advised the class, "Always stay as close to nature as possible and you will find anything you might want along with the easiest and simplest way to do it. Always study nature." Here was the answer to our humidity problem if we would use it. This started me on a line of research on natural weather conditions.

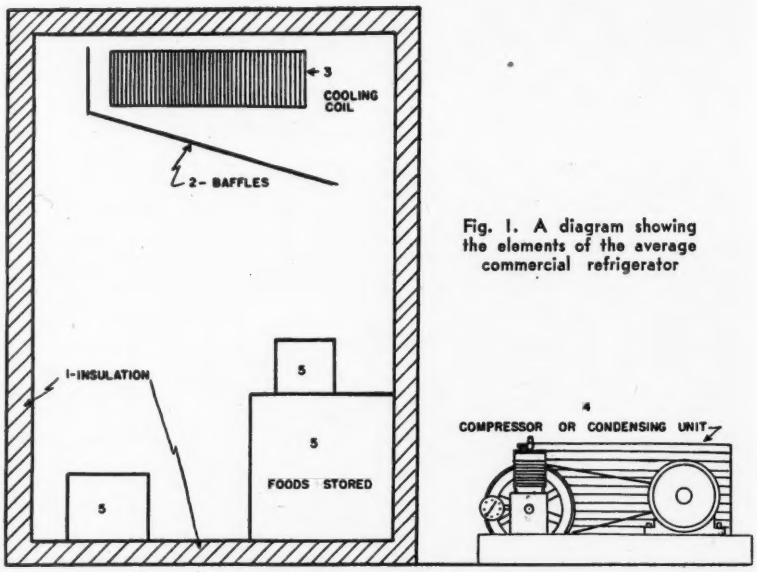
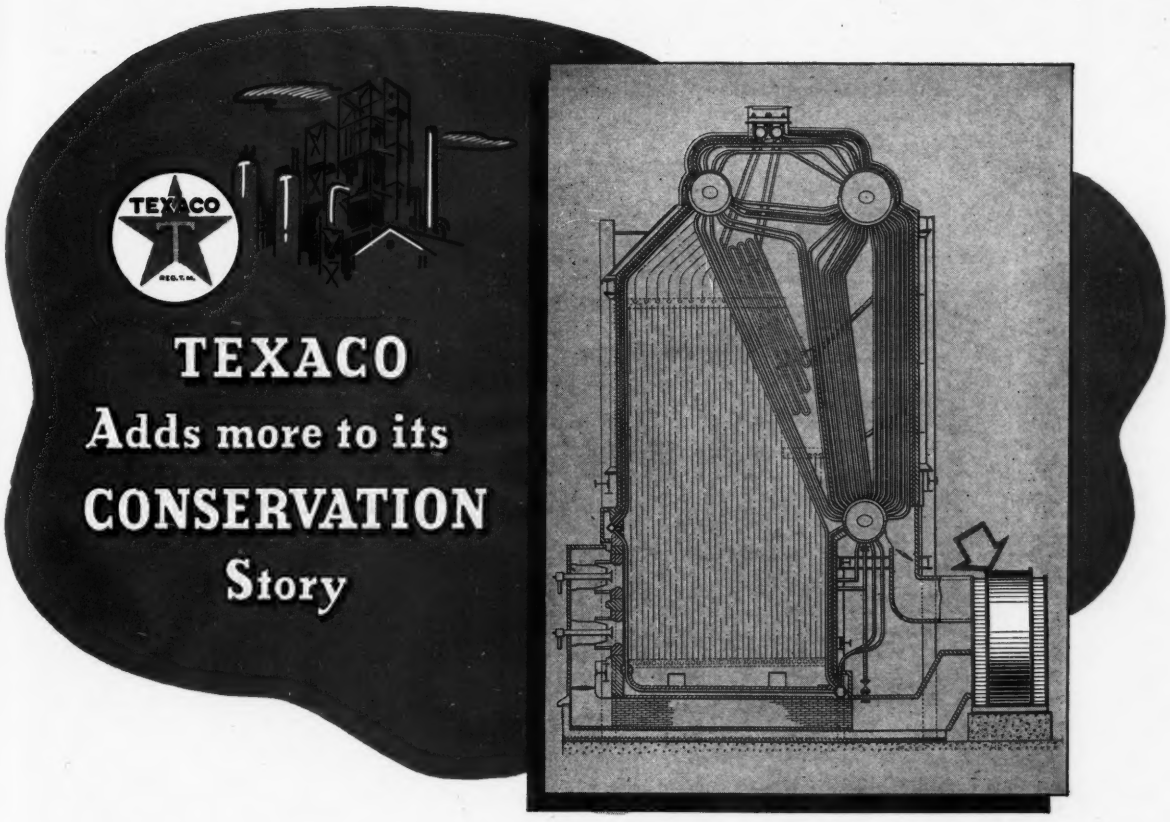


Fig. 1. A diagram showing the elements of the average commercial refrigerator

In the book "Hydrology" by Meyers was the answer that spelled the beginning of the end of our unsatisfactory conditions. It was *Dynamic Heat Transfer* and was discussed to some extent. This means of heat transfer was never described or recognized by any of the manufacturers or text books on refrigeration that I had studied. It is the alternating movement of heat between the water vapor and the various gasses in the atmosphere and between the various gasses themselves. Just as various liquids and solids have a different capacity in the absorption of heat, the same is true of water vapor and the different gasses. The speed of transfer also varies. Of course their heat capacity is far smaller, according to volume, than in the solids or liquids. Although we knew that the heat storage capacity of the vapors were greater than the gasses, we never considered the fact that there might be an alternating flow of heat between them. We also knew that the natural flow of heat was from hot to cold, but we never thought that the condition would change with a reversed flow of heat in turn.

We will now consider evaporation and condensation. This we know to be the effects of the removal or addition of heat to a liquid or a solid. All things are a combination of molecules. In any molecule where heat is present there is a constant vibration, the speed of which is governed by the amount of heat present. The greater the heat the faster and more violent the vibration and the opposite holds true until we would cool down to absolute zero where all motion would stop. As an example, take an open pan of water. Place a flame or other heat source under it and as it warms, the speed of vibration of the molecules in the water increase until they will throw themselves off into the atmosphere in a vaporous form faster than they will fall back into the body of water. Here we have evaporation. If we cool the water to a point lower than the atmosphere then the vapor in the air will fall into the pan of water faster than it is being thrown off and we have condensation. A place where this can easily be seen is on a cold water pipe condensing moisture which is commonly known as a pipe sweating.

Now let us consider again this pan of water under which we have placed the heat. If there is no motion about it will give off only enough water to completely saturate the air about it. Under such conditions the evaporation is only as fast as the water vapor can



Two new steam generators for The Texas Company will duplicate previous units equipped with Ljungstrom Air Preheaters.

Supplementing three previous units of the same design, the Texas Company is adding two 295,000-lb-per-hr steam generators at one of its large refineries. A Ljungstrom Air Preheater of the horizontal type is used on each unit. When operating at capacity, flue gases enter the preheater at 784 degrees F., leave at 413 degrees, heating the combustion air to 512 degrees.

• • • • •

CONSERVATION is not just a war-term to Texaco. The steam generators installed here in 1938 were chosen for high-efficiency heat recovery. At that time, the use of Ljungstrom Air Preheaters had to justify itself in extra fuel economy and improved combustion, solely as a matter of dollars-and-cents.

Now, when two more units are being added, CONSERVATION is more important than ever. Fuel savings are vital at the refinery as elsewhere. And *savings in steel* going into the power plant are equally important to the nation. Both these factors add a further measure of emphasis to Texaco's CONSERVATION policy in reordering Ljungstrom Preheaters.

The continuous regenerative counterflow principle of the Ljungstrom sets it clearly apart from other types requiring long and heavy tube banks. These preheaters average *one-half* to *one-third* the weight of other types for the same degree of heat recovery. Further savings are often made in the supporting structure.

For the complete story on how and why the Ljungstrom is making a significant contribution to wartime power generation, write for booklet "Another Kind of Air Power with a Wartime Job to Do".

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

condense on the walls of the room or vessel if it is enclosed so that there is no change of air. This, you can see in use in waterless cookers. However, if the air is moving across the pan with a fresh supply of air crossing constantly, the evaporation would increase. According to the exhaustive tests of the U. S. Weather Bureau it has been found and proved that as we increase the velocity of the air by two, we increase its evaporating capacity by ten.

Meats, vegetables, fruits, berries and other fresh foods are composed of a high percentage of water. When they are placed in a refrigerated storage the condition and velocity of the air in it will determine their losses in weight and condition from dehydration or condensation. In the present day mechanical refrigerators we

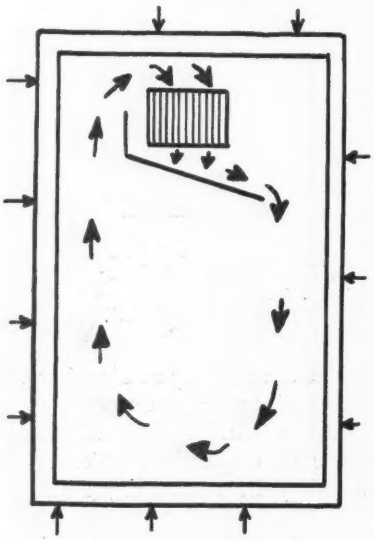


Fig. 2. Heat travel and circulation in a refrigerator

have a number of fixed conditions. Let us examine them and see what part they play. In Fig. 1 we find that the normal average refrigeration unit is composed of the following:

1. Insulation.
2. Baffles.
3. Cooling coil.
4. Compressor or condensing unit.
5. Foods stored.
6. The seasons of the year.

The construction of the walls, top and bottom of a refrigerator along with its doors and windows are all a part of the insulation along with the cork or other materials which are used. The amount and quality of insulation is very important. About 80 per cent of the heat entering average refrigerators in use passes in through its walls and bottom. This determines the size of equipment needed to keep it cool as well as the cost of power to operate it. The first cost of purchasing a refrigerator is the least part of the total cost for to this we must add the cost of operation over a period of years. An extra two or more inches of insulation will more than pay for themselves many times over during the life of the equipment.

Baffles and Bunkerings

Next we have the baffles and bunkering arrangement that serve as air guides and drip catcher for the condensed moisture on the coils. They are arranged in various ways. Each refrigerator manufacturer and builders of mechanical equipment have their own recommendations for this. They have various claims for their particular types, some of which have real merit. There are some, however, that are the same as were used by our grandfathers.

Another part is the cooling coils and compressor. They are made in various sizes and care is usually taken to see that one of sufficient capacity is sold to take care of cooling any given refrigerator. The coils are of various types (pipe, plate, finned tubing, etc.), each of which are recommended for a given purpose. Some types are even supposed to be an attempt at humidity control. The compressor, of course, has only one purpose and that is to remove a given amount of heat in a set time.

The food stored in a refrigerator and the way it is placed is an item that must be considered. The amount of heat necessary to remove from it is from two sources—the heat in it when placed in the refrigerator, and any chemical heat produced by decomposition. The latter, of course, is usually very small.

The seasons of the year constitute the principal factor in determining the amount of heat to be removed. Mechanical equipment must be designed to remove the heat of the hottest day of the year. The operating time of the refrigerating equipment will be determined by the season.

Note: This is the first of two articles on Natural Humidity Control by the author. The second, dealing with the actual development of the system will appear in a subsequent issue.

CONGO CONSTRUCTION

How an American missionary used his college training as an engineer to build a hydroelectric power plant deep in the Belgian Congo is revealed in a series of letters to the International General Electric Co. which supplied much of the equipment.

The missionary, Dr. George W. Carpenter of Saratoga, N. Y., and an engineering graduate of Union College, was the only white man in the force which built the plant at Banza Manteke, a small settlement near the Congo River, to supply light and power for his mission.

Electrical equipment, including a 25-kv-a. generator, transformers, switchboards, and lightning arresters, was carted over primitive roads to the site in a trailer built by Dr. Carpenter.

"We had to fall back on elementary methods," wrote the missionary in a recent letter. "All the earthwork was done by pick and shovel and wheelbarrow, all the drilling of rock by plain bar and sledge hammer and the blasting by time fuse.

"I was the only white person on the job, with about 60 Africans, none of them familiar with any job of this kind. One or two were good carpenters and mechanics, one a fair blacksmith, and three very good masons. All the mechanical and electrical aspects of the work they had to learn as they went along."

Before the equipment could be installed, a canal several hundred feet long had to be constructed, in order to obtain a waterfall of sufficient height to operate a generating station on a practical basis. A cut through a hill, composed mainly of limestone and shale, was made, some of the stone going into the construction of the generating station beside the newly constructed waterfall. Negotiations with a Congo railroad company resulted in permission to use rails from an abandoned spur as poles for the transformers.

In spite of such preliminary construction problems, within a few months after arrival the equipment was in operation at full capacity, delivery light and power to the church, school, hospital, residences, and other buildings at the Banza Manteke mission. So successful has the installation been that Dr. Carpenter has been in demand as a consultant for similar plants throughout the Belgian Congo.

RUST CLOSING IN ON YOUR TURBINES?

DON'T wait for rust to stop your turbines. It's far less costly to drain, flush and refill with new Shell Turbo Oil. Act now! You'll find new, tested and service-proved Shell Turbo Oil meets all 3 requirements of modern turbine lubrication:

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Don't accept less! Call in Shell now!

SHELL

Protect your turbines with RUST-PREVENTIVE

SHELL TURBO OIL

Maintenance Essential To Production

Although this article on maintenance is directed essentially to the maintenance of motors, the rules laid down apply to other equipment as well. A bearing on any kind of machine, whether it be a stoker or a pump, must be kept in good condition these days and every precaution must be taken to see that these bearings do not fail. If nothing is done until smoke issues from a bearing then it is too late to do much of anything except to shut down the machine

By C. W. Fick, General Electric Company

RESPONSIBILITY for keeping industry geared to the tremendous task of producing machinery for winning this highly mechanized war rests on the maintenance engineer.

The maintenance engineer's job may be divided into three main parts:

1. To prevent interruptions or outages which may be caused by accidents to or failures of the electrical service or electrical equipment in the plant.
2. To keep the duration of those interruptions which do occur to a minimum.
3. To plan for increased loads and extensions of electrical service.

The first step in preventing interruptions is to keep an up-to-date list of all electrical equipment in the plant. This should account for every motor, control box, transformer, circuit breaker, as well as electric cables, in terms of size and rated capacity. Next, a regular schedule of inspection must be set up so that the load carried by the electrical apparatus, as well as the condition of the apparatus, is known. If nothing is done until failures actually occur, they will begin popping all around. Production managers are calling for increased output on each machine. If the maintenance engineer knows what that means in the load on his electrical apparatus, he can work closely with the production manager or with the foreman to see that production is not stepped up to a point where a failure of the electrical apparatus will surely occur.

It should not be necessary for motors to squeal for lack of oil, or smoke from overload, before their condition is checked to see what can be done about it. The oil in transformers and oil circuit breakers is expected to serve as an insulating, cooling, or arc-quenching medium. Oil, however, can deteriorate gradually with the result that these characteristics are impaired. Breakdown of equipment has more than once been due to the fact that the dielectric strength of the oil was not what it should have been, or that the oil level was not maintained. Such accidents are really a reflection upon the care and attention given by the maintenance man. Not always, but sometimes. In those cases the accident could have been prevented by the regular inspection schedule.

Transformer supervisors occasionally find an ancient or heavily overloaded transformer in which the oil has congealed to a jelly-like mass. Obviously, in that

Fig. 1. A handy and useful instrument is the hook-on volt-ammeter. This one is being used to measure the alternating current to a motor

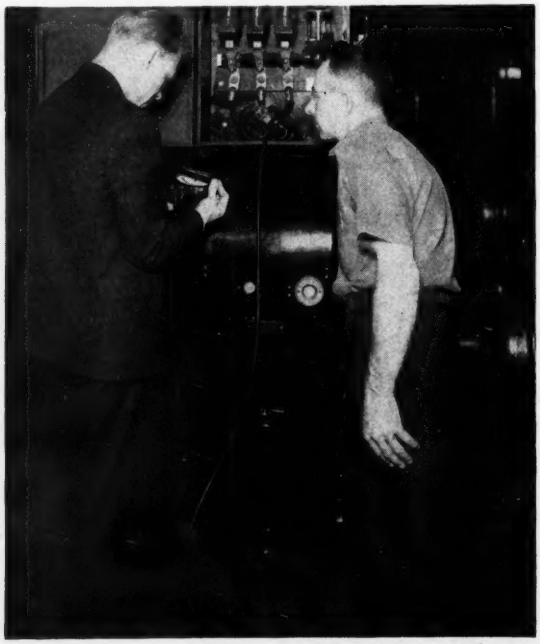
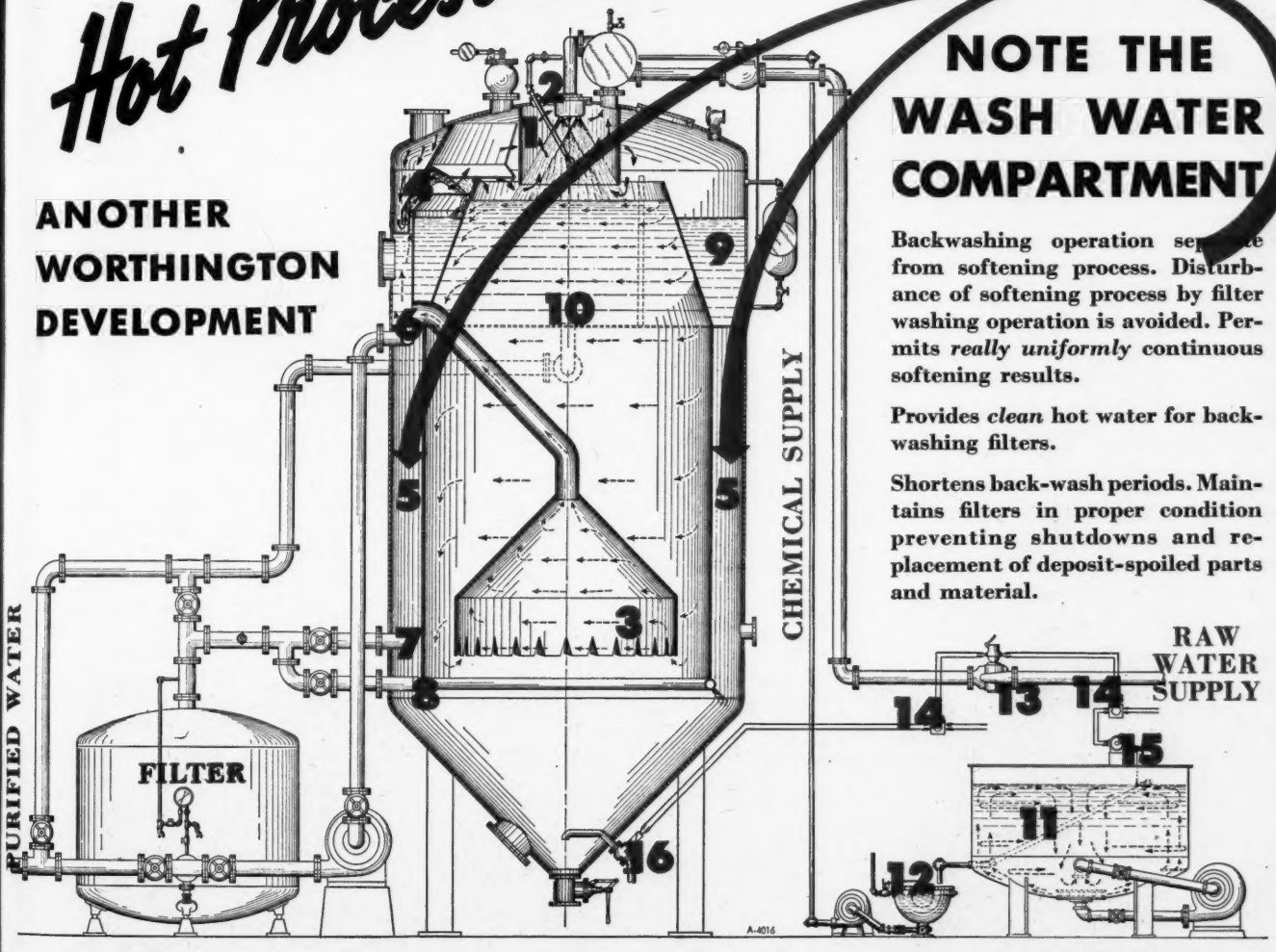


Fig. 2. Motor starting current can be measured accurately by using a portable pointer stop a.c. ammeter in this way with a split-core transformer

The only uniformly continuous Hot Process Water Softener!

ANOTHER WORTHINGTON DEVELOPMENT



NOTE THE WASH WATER COMPARTMENT

Backwashing operation separate from softening process. Disturbance of softening process by filter washing operation is avoided. Permits *really uniformly* continuous softening results.

Provides *clean* hot water for backwashing filters.

Shortens back-wash periods. Maintains filters in proper condition preventing shutdowns and replacement of deposit-spoiled parts and material.

And check these numerous other features

1. Primary Heater. Non-scaling. Efficiently heats the raw water and provides rotary mixing of water and chemicals.
2. Chemical Applicator. Removable. Sprays chemical through steam. Facilitates mixing and reaction.
3. Up-take Cone. Baffled serrations assure even draught. Increases softener capacity 50% over common practice.
4. Deaerating Heater. Simple. Effective. Self adjusting. No moving parts.
5. Wash Water Compartment. (See above).
6. Supply to Filter Wash Pump Suction.
7. Discharge of Dirt Laden Wash Water. Reclaimed by settling clear within 1½ hours.
8. Cleansing Ring. Provides uniform distribution of jets for washing softener precipitate and wash water sediment to central area of conical bottom.
9. Storage for Treated and Deaerated Water.
10. Treated and Deaerated Water Outlet to filters or direct to boiler feed pumps.
11. Chemical Agitator. Maintains chemical mixture of uniform strength. No submerged bearings or paddles. No objectionable surface wave action to interfere with decantation.
12. Chemical Dilution and Pump Suction Tank.
13. Proportioning Meter. Accurate. Low loss. Equipped with totalizing register.
14. Relays. Adjustable time interval.
15. Decanting Mechanism. Sturdy. Reliable. Accurate.
16. Sludge Remover. Removes sludge in proportion to its rate of formation.

For full details Bulletin W-212-B2 is available at district offices (in all principal cities) or at headquarters.

WORTHINGTON

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

H.P.	Syn. Speed	Make	Connection Diagram	Application	Shop or Mill No.	Card No.
Type	Frame	Poles	F. L. Speed	Volts	Form	Temp. Rating	F.L. Amp.	Phase	Cycles
---	---	---	---	---	---	---	---	---	---

Serial No. / Model No. — Publication No.

CONTROL EQUIPMENT — Type — Make — Pub. No.

BRUSHES: No. Per Motor, Cat. No., Size, Material, Grade

LININGS: Front End, Cat. No.; Pulley End, Cat. No.

COILS (Cat. or Spec. No.): Stator or Field — Main, Comm., Comp.; Rotor or Armature — Coils, Bars, No. per Set

Connection Diagram

PULLEY: Diam., Face, Belt Width, Bore, Keyway

Mfr's Order No. / Our Order No. / Date of Order / Cost { Motor / Control

User: / Location:

SERVICE RECORD

Date	Building	Floor	Driving	Drive	Tested Hp.

REPAIRS

Date	Condition	Due to	Repaired by	Cost

GENERAL ELECTRIC SERVICE SHOPS are located in the following cities:

Atlanta	Dallas	Kansas City, Mo.	Philadelphia	San Francisco
Buffalo	Detroit	Los Angeles	Pittsburgh	Schenectady
Charleston, W. Va.	Erie	Milwaukee	Pittsfield	Seattle
Chicago	Fort Wayne	Minneapolis	St. Louis	West Lynn (River Works)
Cincinnati	Houston	New York	Salt Lake City	West Lynn (West Lynn Works)
Cleveland				

Fig. 3. Card for keeping a record of motors installed, and service and repair. (View shows both sides of card)

condition the oil cannot do the job expected of it, either as an insulating or cooling medium.

Motor bearings fail because of lack of oil, and with the heavier and higher speed machines, the results of bearing failures can extend beyond merely bearing replacements. Sufficient heat may be generated to spring the shaft, or the rotor may rub on the stator damaging the laminations with a consequent expensive repair job. In these times it is more than ever necessary to prevent bearing failures because of the scarcity of bearing materials. Copper, tin, and antimony, which go into the make-up of the babbitt, are now on the critical list.

Improper brush pressure can result in flashovers of commutators, or arcing at collector rings. It is such an easy matter to keep the brush pressure at recommended values that there is really no excuse for troubles of that sort.

In many plants the wire and cable are being called upon to carry excessive loads. The cables themselves may not show distress, but they may have been figured for a certain voltage drop at normal currents, and when those currents are greatly exceeded the voltage delivered to the motor or to the apparatus may not be sufficient to permit that machine to do its job properly. A 10 per cent voltage drop results in a 19 per cent loss of torque in an induction motor. That actually means a decrease in the production of the machine driven by that motor, and today we are looking for increased, not decreased, production.

Keeping Outages to a Minimum

The wise maintenance engineer plans on some failures occurring even though he takes every precaution to prevent them. Experience and a careful check on loadings will generally indicate possible danger points. The best procedure is to (1) have spare parts available; (2) if possible have a spare machine ready to install in place of the one that fails; and (3) know where each type of apparatus can be repaired most reliably and quickly, so that in case of failure, no time will be lost in locating a suitable repair shop. This is good information to have on the card record of each machine.

Planning for Extensions of Service

Where a new machine is to be added it is often possible to simply extend an existing cable run without overloading the cable or causing excessive voltage drop. This should be done intelligently, of course, knowing both the capacity of the cable and the load it will be called upon to carry.

Major plant extensions, on the other hand, will require entirely new feeders, and in such cases it

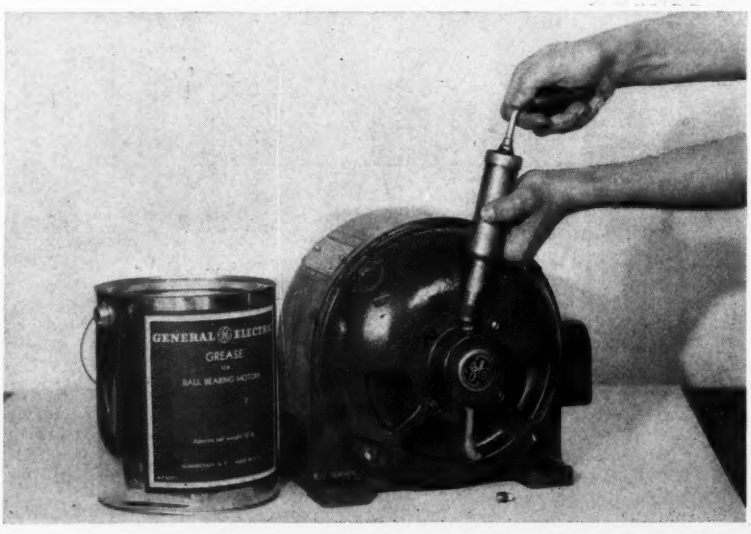
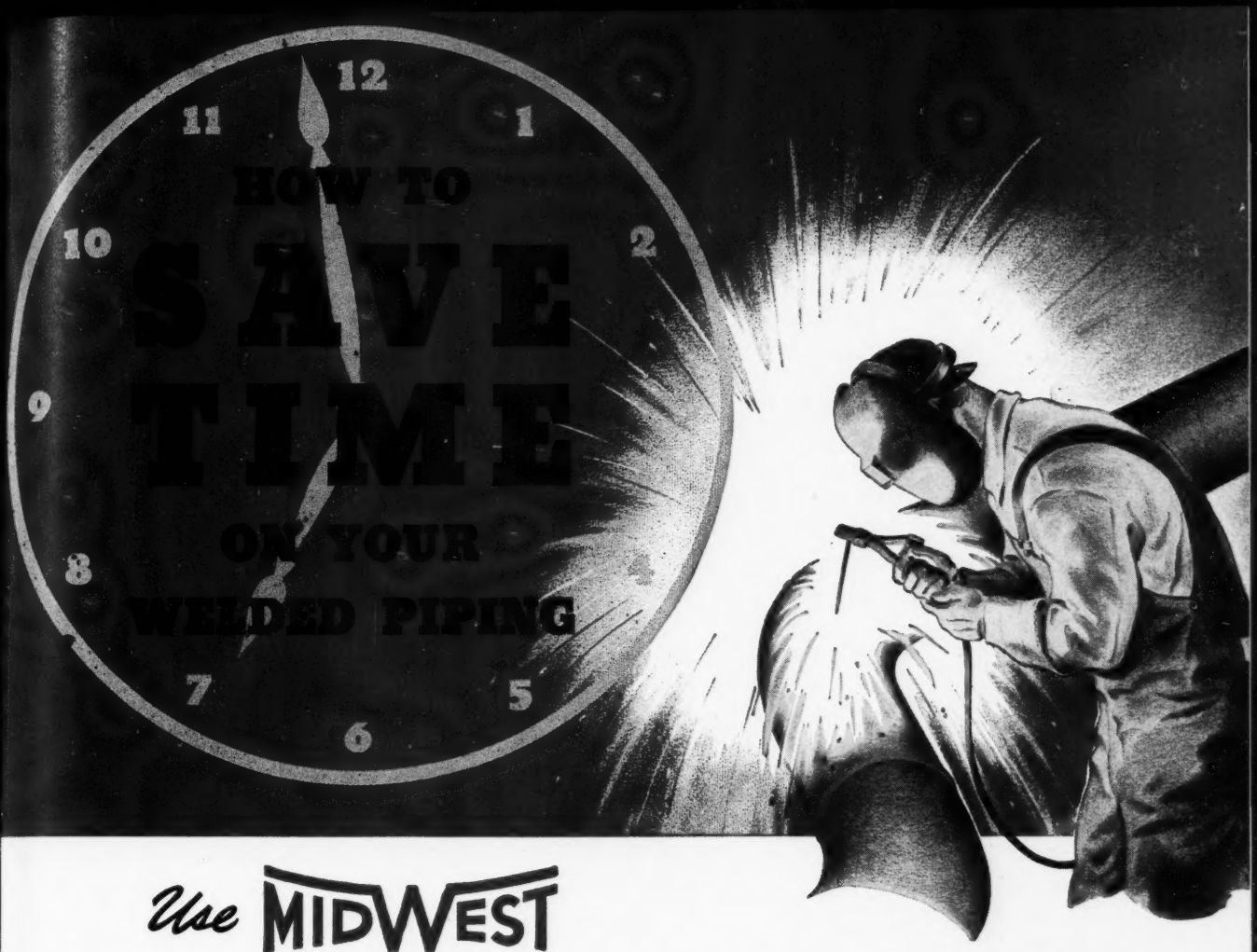


Fig. 4. For convenience of maintenance men, many motors have ball bearings arranged to be greased with a pressure gun. As new grease is added by means of pressure gun old grease is expelled through relief hole in bottom of bearing housing

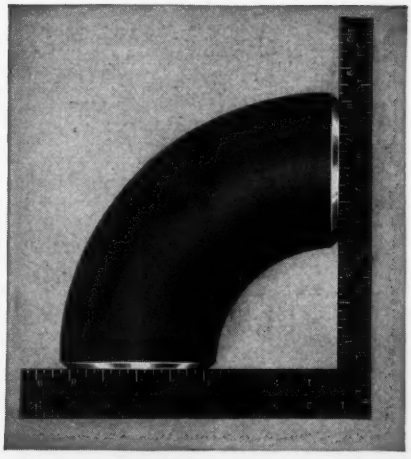


Use MIDWEST
WELDING FITTINGS

Now that "time" is the critical factor on so many welded piping jobs, it is more important than ever before to utilize the time-saving characteristics of Midwest Butt-Welding Elbows.

Qualified pipe welders report that Midwest Elbows save time and trouble on the job because they are always accurately to dimension . . . and because they are always uniform. Time is saved not only in lining up and in welding, but also because all pipe can be cut in advance according to drawings. Another important advantage is that more uniform welds are assured.

These features result from the design and from the unique process used in the manufacture of Midwest Welding Elbows. They are first made slightly oversize . . . then accurately sized in compression at a forging heat. Special fixtures and machine tools assure accurate finishing. Ask for Bulletin WF-41 which gives all the facts.



(above) Exact included angle is the result of special fixtures and tools developed by Midwest for machine-beveling the ends.

(right) Sectional view emphasizes uniform wall thickness and true circular cross-section of all Midwest Welding Elbows (both Standard and "Long Tangent").

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 So. Second St., St. Louis, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—949 Marquette Bldg. • New York (Eastern Division)—30 Church St. Los Angeles—520 Anderson St. • Houston—229 Shell Bldg. • San Francisco—535 Call Bldg. Tulsa—533 Mayo Bldg.

MIDWEST WELDING FITTINGS SAVE TIME, IMPROVE THE DESIGN, AND REDUCE THE COST OF PIPING SYSTEMS

is suggested that specialists be consulted. Incorrect methods of supplying power to new plants and to plant extensions cost excessively and waste materials. Studies have been made which prove that the load-center distribution method of supplying power offers many advantages. In this method a factory-built unit substation is installed at the load center and fed by high-voltage cable, in contrast with the older method of bringing the high-voltage cable to an outdoor substation and then having long runs of low-voltage cable. The unit substation method permits the use of smaller transformers, which in turn permit the use of smaller rupturing capacity breakers, and it keeps the length of runs of heavy, low-voltage cable to a minimum. Time is saved in the installation of such a distribution system, and frequently the cost is reduced by 20 per cent.

To sum up, the maintenance engineer's job is, first, to know at all times the condition of his apparatus; second, to know the loads the apparatus must carry; and third, correct the weak points before they fail. Doing a good maintenance job can contribute directly to the War effort.

War News From the Industrial Front

Transfer Idle Copper Stocks

TRANSFERS of copper from idle and excess inventories to producers needing this critical metal for the manufacture of munitions, planes, tanks, and other implements of war are aiding hundreds of war plants to maintain schedules and, in many instances, are preventing complete shutdowns when emergency shortages occur.

This was revealed September 9 when the inventory and requisitioning branch of WPB announced that 29,700,000 lb. of copper and copper base alloys have been allocated from immobilized stocks to war production channels through the WPB's copper recovery program, instituted 8 wk. ago.

Of this total 2,400,000 lb. were allocated for stockpiling to meet future anticipated demands for standard shapes and sizes of mill products; 6,300,000 lb. were reported and allocated as scrap; 9,300,000 lb. were allocated, or known to have been moved for use in existing form under Priorities Regulation No. 13, and 11,700,000 lb. were allocated to brass mills and ingot makers for remelting.

75 Per Cent of Steel Direct to War Uses

MORE than 75 per cent of the Nation's finished steel output of 5,300,000 t. per mo. now is going into direct war use and the remainder into such essential industries as railroads, machinery manufacture, and the like, David F. Austin, acting chief, iron and steel branch, reported September 10. Eighty per cent of our steel is being delivered on ratings of A-1-a or higher.

Lumber Shortage Expected

BECAUSE of Lend-Lease requirements, and heavy construction programs of the Army, Navy, and National Housing Agency, Ben Alexander, special assistant on lumber in the Office of Industry Operations, said, "It is estimated that the available supply of lumber will fall 6,000,000,000 board feet short of meeting this year's estimated 38,000,000,000 board-feet requirements." Thus all manufacturers of brick, tile, and gypsum board and the membership of unions within the industry will be called upon to aid in averting "a serious temporary shortage of lumber."

Copper Chemicals Under Complete Allocation

COPPER chemicals were placed under complete allocation control by the Director General for Operations September 9 in order to conserve copper scrap from which they are made. The order, M-227, lists copper chemicals as copper sulphate, carbonate, chloride, oxide, nitrate and cyanide. Allocation will take effect October 1. Small order deliveries may be made by certification from the purchaser to his supplier. Limits on these small deliveries are 450 lb. of copper sulphate or 25 lb. of the other chemicals in any one month. The standard chemical forms, PD-600 and PD-601 must be used by those seeking allocation.

Laying of Southern Petroleum Pipe Line

PETROLEUM Coordinator for War Ickes announced that laying of the Government-owned, Carabelle-to-Jacksonville trans-Florida pipe line is scheduled to start on or about October 1 and that it is expected that construction can be completed by December 15.

At that time, the line will commence delivery of 35,000 bbl. of petroleum products daily to Jacksonville, from where it will be distributed by barge to consuming centers along the route of the Atlantic intra-coastal waterway as far north as Virginia.

The line is to be constructed entirely out of second-hand equipment, which is being dug up and dismantled in Texas for shipments to Florida.

Tin is Scarce and Vitally Neded

TIN AND SCRAP steel are both in the front ranks of critically short war materials. Our normal peacetime need of 65,000 to 70,000 t. of tin a year, and 110,000 t. in 1941, over 98 per cent of which we imported from the Far East, is this year being cut to 62,000, and to 48,000 in 1943. Even with this drastic cut, and with domestic production of tin from Bolivian ores, our available supply is far short of essential needs.

New Ratings for Oil Industry Materials

A-1-A and A-2 preference ratings have been assigned to deliveries of all materials used in the production branch of the oil industry and those used for maintenance and repair purposes or as operating supplies in other branches of the industry.

Ratings were assigned in Preference Rating Order P-98-b, which was issued September 15 by WPB.

Operators will continue to use Form PD-200 to obtain preference ratings for the delivery of materials used in new construction in the refining, natural gasoline manufacture, transportation, and marketing branches.

The new order, effective until January 1, 1943, supplants Preference Rating Order P-98, under which the oil industry previously obtained materials.

Electronic Devices Under Strict Control

ELECTRONIC devices involving the use of vacuum or gaseous tubes will be brought under further control by the WPB.

Limitation Order L-183, effective October 3, covers considerably more ground than L-44, issued last spring, which prohibits only the manufacture of civilian radio receiving sets. Although none of the provisions of the latter order is affected, the new order extends coverage to everything else used in the electronic field from microphones to antennae, and including tubes, parts and complete equipment.

It provides that no one may manufacture, fabricate, assemble or produce electronic devices in excess of a minimum inventory required to meet deliveries on orders rated A-3 or higher. Inventories are permitted up to a 45-day supply, but may not in any case exceed 12½ per cent of total 1941 sales.

Priority Applicants to Use Revised Form

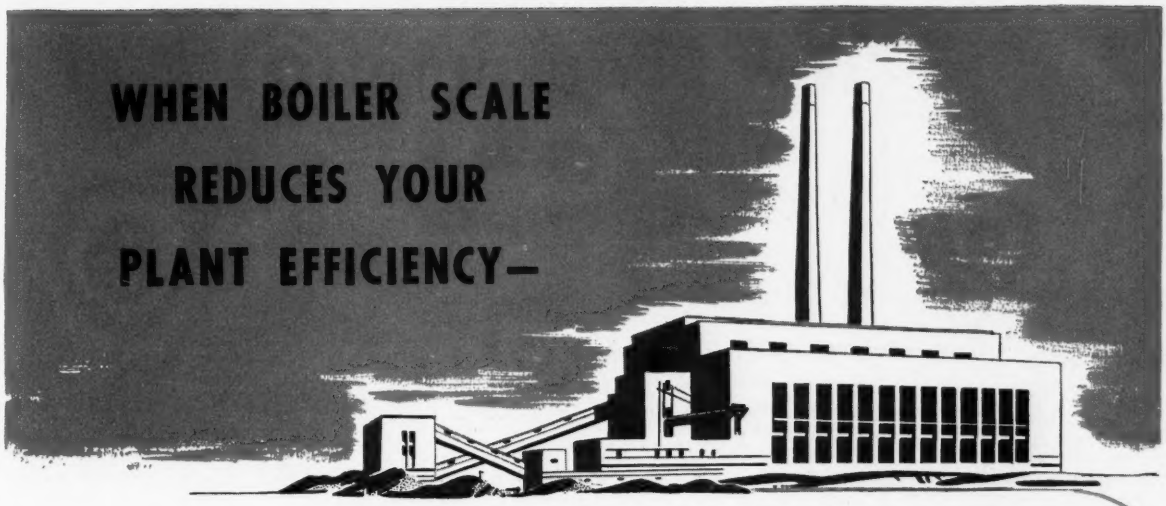
APPLICANTS requesting priorities assistance or authorization to begin construction under provisions of the stop-construction order, L-41, must use the revised form PD-200 after September 30, the WPB announced September 18.

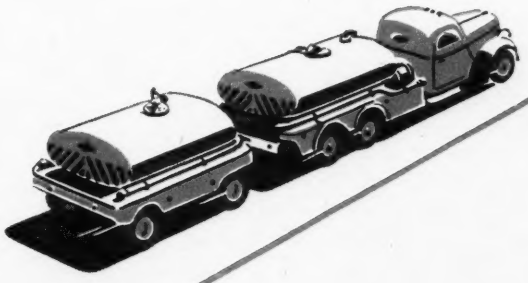
Varieties of Light Bulbs Reduced

LESS than half of the various types of electric light bulbs and lamps currently produced will be manufactured after November 1 under terms of a simplification order announced September 18 by WPB.

Moving to conserve materials and production capacity in the incandescent and fluorescent lamp industry, the WPB ordered that types of bulbs now made be reduced from 3500 to 1700.

There will be no curtailment in the total production of electric bulbs as a result of the action.





DOWELL CHEMICAL SERVICE

WILL REMOVE THE SCALE *QUICKLY* AND *COMPLETELY*

THROUGH CHEMISTRY has come a better, more effective way of removing scale from heat exchange surfaces. Dowell Incorporated, together with its parent company—The Dow Chemical Company, has developed and perfected a *chemical* method of removing boiler scale, quickly and completely.

This Dowell method is the *fastest, safest* and most *efficient* ever devised for removing water deposited scale from all types of heat exchange surfaces. It does a better job than either mechanical or manual methods and does it in just a few hours where the old-fashioned practices took days. It saves precious time—it keeps vital power equipment operating at peak wartime production.

If you are looking for more boiler capacity and less time off the line—let us give you the complete story about Dowell Chemical Scale Removal Service. Wire, phone or write our general offices in Tulsa—there's no obligation.

Look to DOWELL FOR INDUSTRIAL SCALE REMOVAL SERVICE

DOWELL
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Executive Office:
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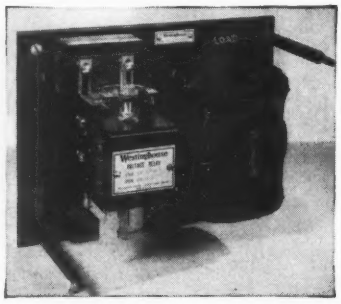
General Office:
Kennedy Building, Tulsa, Okla.
Subsidiary of
The Dow Chemical Company

New Equipment

Information that you desire about any equipment will be gladly furnished without obligation. WRITE POWER PLANT ENGINEERING.

Automatic Synchronizers

A NEW automatic synchronizer, type XK, to provide a practical device for automatically synchronizing small generators, was recently announced by the Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.



The type XK automatic synchronizer is limited in use to a.c. machines having a kv-a. rating of 250 or below and a voltage rating of 600 or less, with a suitable governor and fast closing machine contactor or breaker. One synchronizer and control switch is used for opening the machine contactor coil circuit when it is held closed magnetically. If the contactor is held closed by a latch and tripped electrically, the switch is used in the trip coil circuit. These automatic synchronizers are available for 50-60 cycle service.

Saflex Feeder Duct

ANNOUNCEMENT has been made by the engineering department of the Switch & Panel Division, Square D Co., Detroit, Mich., of a new low reactance feeder duct. The duct is designed primarily to serve as the feeder between transformer banks and main switchboards or as feeders to branch circuits where minimum voltage loss is essential.

It is also suited for welder circuits as it provides a compact conductor of low voltage drop (1.8 v. per 100 ft.), thus keeping conductor size at a minimum. As the duct is principally enclosed in a special non-critical non-metallic insulation, the absence of enclosing steel eliminates iron losses and hum, as well as the pulsations experienced from the impact of heavy welder loads.

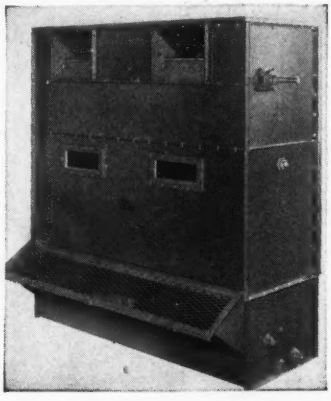
Saflex Feeder Duct is said to provide balanced phases at all points due to a special split-bus arrangement which provides electrical symmetry of the phases.

This duct is available in capacities from 500 to 6000 amp., 600 v. or less for single-phase, 2 and 3-phase and 3-phase, 4-wire services.

Aquamisers

A NEW line of type EVS Aquamisers (evaporative condensers) with a complete range of sizes from 5 to 100 t. normal refrigeration capacity was announced by the Westinghouse Elec. & Mfg. Co., 653 Page Blvd., Springfield, Mass.

These new aquamisers are used as condensers for Freon refrigeration compressors and also as process liquid coolers. A few typical applications include: jacket water cooling for Diesel engines and air compressors; quenching oil cooling, and anode cooling. The temperatures to which liquid can be cooled by this means depend upon the wet bulb temperature of the air, the kind of liquid, and its entering temperature.

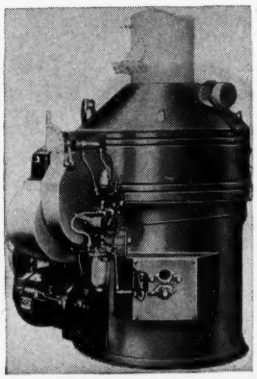


Such recalibration disturbs neither the cam and roller movement nor the Bourdon tube, for the angularity of the linkage remains unchanged. A turn of the Adjust-a-matic screw merely causes the freely-mounted pointer shaft to rotate sufficiently to return the pointer to the proper position. Correct calibration is afforded throughout the dial range, and is insured when this recalibrating mechanism is incorporated in the Certified Gage.

The aquamisers consist of three major sections: fan, condenser and sump. Individual sections are of size and weight to permit easy handling and erection. The casing is made of heavy, galvanized sheet steel and all parts are adequately protected against corrosion and severe operating conditions.

Steam Generator

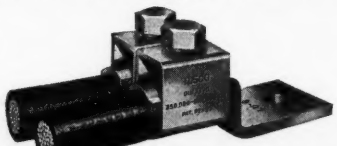
A NEW recirculated type steam generating unit for use where there is a demand for a steady source of steam or an emergency unit, has been developed and is being manufactured by the Vapor Car Heating Co., Inc., 80 E. Jackson Blvd., Chicago, Ill. This generator is said to produce steam from a cold start to pressures up to 300 psi. in less than 2 min. It is available in standard packages of 500, 1000, 1500, 2000, and 3000 lb. evaporation per hr. The unit, completely automatic or semi-automatic according to the specified requirements, requires no boiler room or high draft stack.



The staggered steel tube coil assembly is easily removed for cleaning. It is fully compensated for expansion and distributes hot gases with high thermal efficiency. A single motor drives all accessory units with water blower and fuel feed controlled by steam demand. Interlocked automatic regulation assures safety. The continuous coil construction affords protection against explosion or escaping steam, even though the steam generator may suffer from external damage of any type.

Multiple Solderless Connectors

THE Ilsco Copper Tube & Products Co., Mariemont, Cincinnati, O., has recently placed on the market their latest development in multiple solderless connectors. Two of these new multiple connectors are available, LU4 which holds



wires from 0 to 350,000 cir. mils and LU6 which holds wires from 250,000 to 500,000 cir. mils. The connectors are simple in design and make a neat installation of maximum efficiency. No special tools are needed as speedy connections are made with wrench or pliers. Utmost electrical efficiency is assured by the use of pure copper of highest conductivity.

NOW a 2300-volt short is a drop in the bucket

COMPLETE PROTECTION and LONG START-STOP SERVICE

----You get them both in this new 2300-volt starter

THINK of a starter that's built for repeated start-stop service and yet has enough back-up protection to stop a 2300-volt short in a split cycle! You get that kind of service with this starter. It will operate more than a million times with only routine maintenance, and at the same time, provide you with complete protection for your motors, control, and operating personnel. It isn't a mystery control. We combined our long-lived, oil-immersed contactor and EJ-2 current-limiting fuses in one compact, metal-enclosed control unit, and here are the results.

DEPENDABLE OPERATION

The oil-immersed contactor is built to last. Corrosive elements can't get at the operating mechanism. Extra-heavy, self-cleaning copper tips prevent pitting and assure positive contact. Wide metal bearings provide for smooth, continuous contactor operation. Extra-flexible, copper-braided shunts are designed to withstand the severest start-stop operation without breaking or pulling away from their contact. All these features combine to give you a contactor that is going to stay on the job under the toughest of conditions.

FULL PROTECTION

At 2300 volts you want fast, positive short-circuit protection. That's where the EJ-2 current-limiting fuses come on the job. They're split-cycle fuses. When a short occurs, they cut off the current in less than a quarter cycle and clear it in less than a half cycle—long before the short has had time to harm the contactor or motor.

Isothermic overload relays calibrated accurately against actual motor characteristics protect the motor against overheating from sustained overloads, locked rotor, or single-phasing.

Fuses and overload relays working together assure you of full protection at all times.

You'll want to know all about this brand new motor control. How the bus bars are enclosed for the operators' protection. How a group of these starters can be fitted together to give you a neat, compact control panel. Ask your G-E representative for our new bulletin—GEA-3660. It gives full details. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

Fire Extinguisher Cabinet

FOR PROTECTION against sabotage or accident a tamper-proof cabinet, known as Tam-Pruf, has been announced by the Erie Supply & Equipment Co., 426 Huron Ave., Sandusky, O.

The housing which is made of metal or is available in other materials, provides proper protection to fire extinguishers until the time for use. The extinguisher is visible through glass windows in the sides and is padlocked to prevent tampering. In case of emergency the cabinet may be opened by pressing the palm of the hand on the breaker arm.

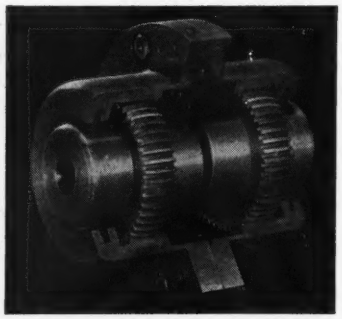
The cabinet affords protection from weather and atmospheric conditions, free from grease, dirt and grime, reduces corrosion and gives longer service.

Alining Shaft Gear Coupling

FOR SOLVING misalinement problems, the Barcus Engineering Co., 3931 Falls Rd., Baltimore, Md., recently announced a new alining shaft coupling. This coupling for driving and driven shafts comprises a cylindrical housing shell cut with internal gears having stub teeth with 20 deg. pressure angle. The driving and driven shafts are respectively connected to hubs of generated gears each cut on a true central segment of a sphere, the surface of teeth being of constant width throughout their length. The teeth of each spherical gear meshing in the stub teeth of the housing produces a smooth ball action contributing to the reduction of friction and pressure on shaft bearings if the shafts are out of alinement. The specially designed spherical gear is in full mesh on pitch line with internal gear at all times and with maximum reduction of back lash.

The nature of this spherical gear permits misalinement up to 3 deg. on either shaft, or a total misalinement of 6 deg.

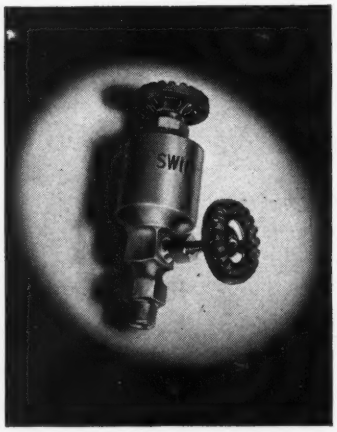
Construction features include, floating housing shell cut with internal gears at each end; hubs with generated spherical gears; oil seals of flexible composition material; clearance space between hubs to allow for end thrust; gasket between flanges to ensure oil tight seal;



bolt holes counterbored for safety to prevent bolt heads and nuts from extending beyond flange surface; and an oil hole with safety set screw.

Graphite-Beeswax Lubricator

WHERE exhaust steam is used for process work or the exhaust is condensed and the water used again in the boilers, a graphite-beeswax compound, manufactured by the Swift Lubricator Co., 53 James Bldg., Elmira, N. Y., is used for occasional lubrication of steam cylinders where regular steam-cylinder oil is objectionable. Designated as HP-46 high-



pressure lubricator, it is used extensively on steam lines of steam driven pumps, fan engines, generating sets, winches, hoists and other marine auxiliaries. Capacity 2½ oz. with either ⅜ or ¼ in. I.P. thread shank. The body is made from high pressure steam bronze composition, and valves are equipped with self-cooling iron handles.

Cellulose Acetate Insulated Coil

HIGH CORROSION resistance in bobbins for coil windings has been achieved by Precision Paper Tube Co., 2033 W. Charleston St., Chicago, Ill., by construction in which cellulose acetate is embodied in the bobbins.

Cellulose acetate is used in combination with the spiral-wound dielectric fish-paper core and vulcanized fibre flanges. Spiral wound laminations of cellulose acetate are made over a die to the O.D. of the core and then with a press-fit, slipped over the core to form a spacing tube. The length of the acetate determines the winding area. The inside faces of the fibre flanges are laminated with cellulose acetate before die-cutting, the core then swaged, locking the flanges in place onto the core carrying the spacing tube. Acetate cement is brushed over the joinings to give complete protection and to materially strengthen the bobbin.

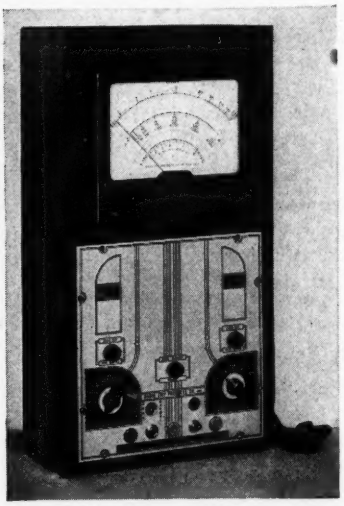
Uses of this form of coil bobbin are wide; instruments and equipment on aircraft, ordnance, marine services and all uses in which coils are subject to corrosion due to temperature and climatic changes.

The bobbins are furnished in all forms—round, square, rectangular, and special shapes to fit engineering conditions.

3 in 1 Multitester

MAXIMUM sensitivity, flexibility and utility are combined in a new vacuum tube multitester recently announced by Radio City Products Co., Inc., 127 W. 26th St., New York City. This instrument, designated as Model No. 662, is actually an electronic voltmeter, ohmmeter and capacitymeter in one, with an extremely wide and useful range of applications in laboratory and production-line tests, service work, etc. The multitester is a vacuum tube voltmeter on a.c. and not a copper oxide rectifier type; and is said to furnish accurate and comprehensive capacity readings directly in microfarads, with a measurement ratio of 40,000,000 to 1.

The meter is said not to damage by checking a live resistor or by using a low range on high readings. Error due to line voltage fluctuation is eliminated by a regulator tube and associated circuits.



While this model employs a sloping panel and 4½-in. meter, the company has also designed an upright-style companion model (No. 662-V-7) with a large 8½-in. rectangular meter, affording long scales for easy reading.

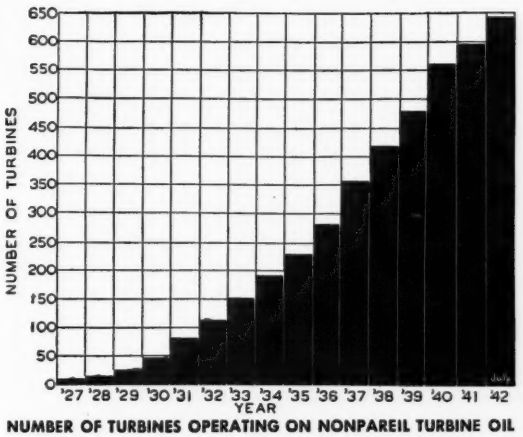
Both instruments have similar performance characteristics and are complete with leads and large, readily accessible batteries, tubes and pilot light.

(Continued on Page 130)

Facts about TURBINE OIL OXIDATION AND SLUDGING

. . . AND INHIBITORS THAT PREVENT THEM

These facts about the prevention of turbine oil oxidation through the use of Nonpareil Turbine Oil, an inhibited oil, are based not merely on laboratory studies. They have been proved under actual operating conditions, in some turbines for as long as 15 years. The number of Nonpareil users has grown steadily, as shown by the chart at right.



NUMBER OF TURBINES OPERATING ON NONPAREIL TURBINE OIL

CAUSES OF TURBINE OIL OXIDATION AND SLUDGING

Petroleum oils are extremely complex mixtures of hydrocarbons which differ widely in their resistance to oxygen absorption or oxidation. Unstable hydrocarbons when left in a turbine oil form numerous types of oxidation products. Asphaltenes and organic acids are the most common.

Asphaltenes tend to precipitate as sludge, while both asphaltenes and acids serve as emulsifiers in the presence of moisture. The acids also may attack metal surfaces, forming metal soaps which settle out of the oil and deposit in low temperature areas in lines, coolers, etc.

PROBLEM OF REFINING TURBINE OILS

While it is possible by refining processes to remove the asphaltene-forming, unstable hydrocarbons from a turbine oil, such rigorous treatment may destroy much of the lubricating value of the oil—a factor called "oiliness"—and render the remaining hydrocarbons peculiarly susceptible to rapid acidity development.

We know of no *refining* process alone that will prevent acidity development as a result of oxidation in oils. This can be accomplished only by first removing the asphaltene-forming hydrocarbons and then stabilizing the remainder with suitable antioxidants or inhibitors.

OXIDATION CONTROL IN NONPAREIL

NONPAREIL TURBINE OIL receives its freedom from *sludge deposits* by a special process of refinement which does not impair its lubricating quality, and its freedom from *acidity increase* by the use of *patented* inhibitors which are stable and free from deleterious effects.

Although the antioxidants in NONPAREIL are very slowly consumed in service, as are all antioxidants, they are automatically replenished by the addition of makeup oil normally added to overcome losses due to evaporation and leakage.

SERVICE RECORDS PROVE NONPAREIL OVERCOMES OXIDATION AND ACIDITY

Accurate service records from 640 turbines operating on Nonpareil prove that excessive acidity, oxidation, and sludge formation are completely eliminated where simple filtering or centrifuging equipment is used to keep foreign contaminants out of the oil and where a small amount (usually 10% per year) of makeup oil is added to replenish the inhibitors. There are many installations where Nonpareil has been in service from 10 to 15 years without batch treatment, resting, or replacement, and where its neutralization number is still 0.05 mg. KOH/gm. Acidity in Nonpareil is *guaranteed* not to exceed 0.15 for the life of your turbine.

A Standard Lubrication Engineer will gladly answer any further questions you may have about Nonpareil. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

NONPAREIL TURBINE OIL

1. Stability Against Oxidation and Sludge.
2. Non-Corrosive. 3. Good Demulsibility.
4. Proper Viscosity Grades.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA)

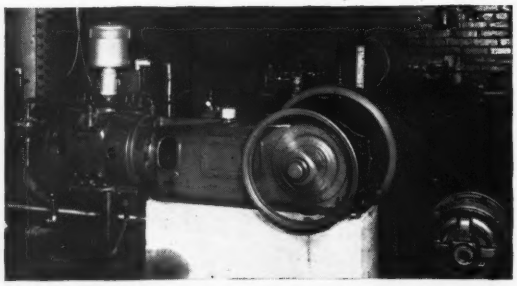
• • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICAT

...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICAT

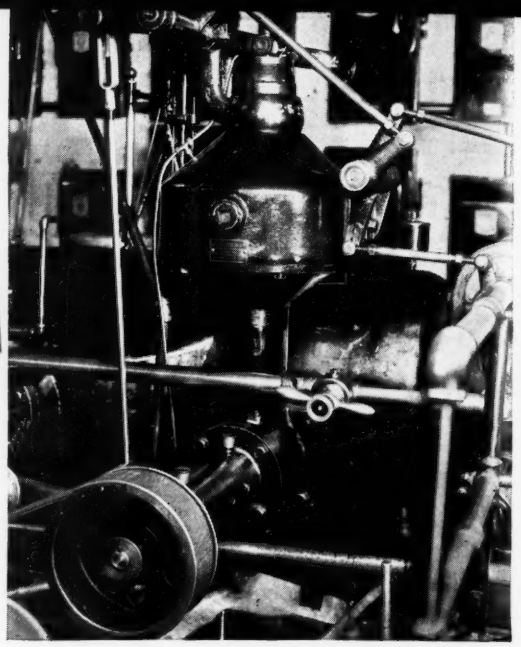
HOW BETTER LUBRICATION HELPS REDUCE SHUTDOWNS

● OVERHEATED BEARINGS—sticking compressor valves—sluggish governor operation on steam engines—excessive wear on machine clutch rings. These are the problems, briefly outlined here, which Standard Lubrication Engineers have solved, to help harried plant men keep their equipment producing. They're just a sample of the many ways these Engineers have reduced maintenance, shutdowns, and delays through recommending lubricants and lubricating methods to meet today's demands on plant equipment. These examples may suggest ways an Engineer can help you.

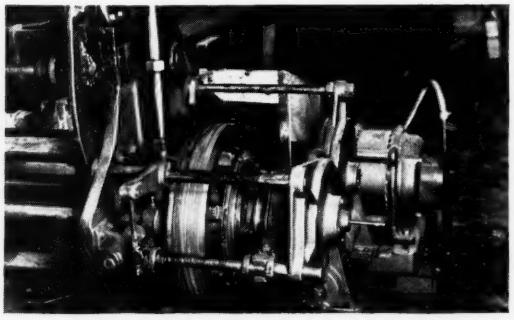
TUBE MILL BEARING TEMPERATURES were high—250° to 300° F.—because of friction of iron pellets used to finish grinding the cement in the mill. Two plain bearings supported the 40-ton loaded mill. The grease used was rapidly consumed. It failed to give adequate protection. A Standard Engineer's recommendation—STANOLIND MILL GREASE—was tried. Consumption was cut in half, with perfect lubrication of the bearings, even at the high temperatures.



STICKING COMPRESSOR AND UNLOADER VALVES caused by gummy deposits from oil, in a compressor similar to the unit pictured above, required considerable time out for cleaning. STANOIL was one of the oils tested to eliminate the trouble, and in spite of slightly higher price, was finally adopted. Stuck valves were eliminated and maintenance costs reduced. This reduction, with the reduced oil consumption, easily offset the slightly higher price of STANOIL.



GOVERNOR OPERATION WAS ERRATIC on a Corliss engine. Examination showed sludge deposits in the governor casing. Again, STANOIL—a highly stable oil—was recommended by the Lubrication Engineer. No deposits have appeared in almost a year. More flexible operation of the governor enables the engine to meet fluctuating loads.



CLUTCH RINGS ON A MACHINE DRIVE had to be torn down and cleaned every 30 days to remove resinous deposits. Even then, rings failed frequently. After changing to SUPERLA GREASE—a Lubrication Engineer's suggestion—there have been no ring failures in six months. Inspections show no deposits and no hardening effect on the rings due to lack of lubrication.

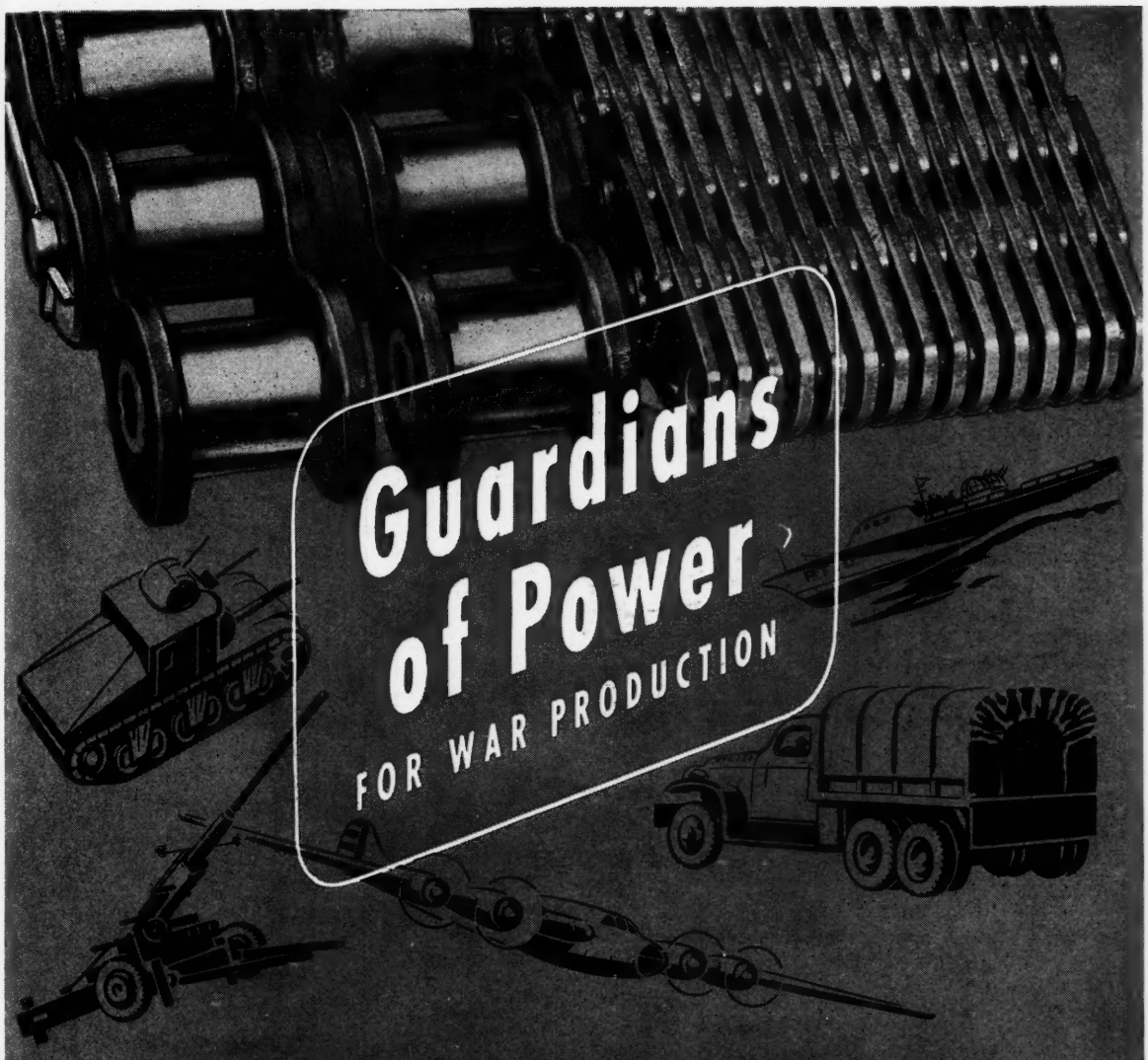
HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or write 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIAN



To maintain peak war production, you need efficient transmission of power. Virtually, Morse Silent and Roller Chain Drives are guardians of power—a positive safeguard against creep, chatter, slippage and waste. Regardless of speeds, overloads, shocks, or elements, Morse Chain Drives deliver full power constantly at high efficiency. Maintenance is practically non-existent. Morse Representatives are ready to help you in your war production with chain drives engineered to the job.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

Simplified Shut-Off

Saves Time and Costs Less

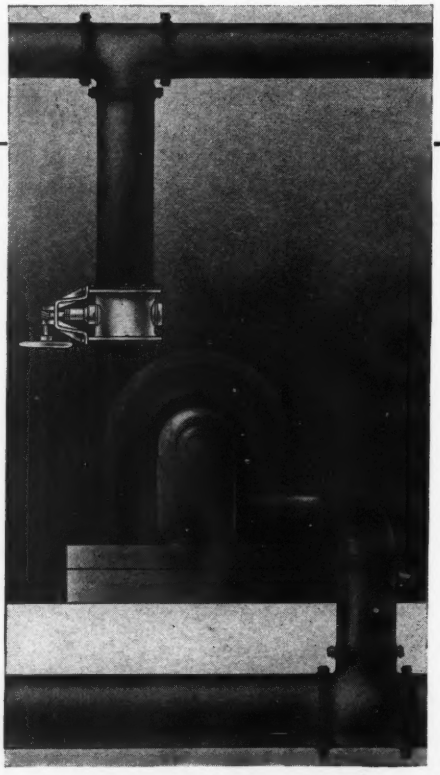
Consider the application of R-S manually operated Butterfly Valves where a battery of synchronous-driven pumps discharges into a common header.

Equipped with handwheel or chainwheel control, the standard 125-lb. valves not only fulfill all requirements to better advantage but cost less to purchase and install than conventional type valves.

Normal procedure when starting a pump is to shut off the discharge valve until the pump has gained the desired speed. The valve is then opened gradually. The operator often neglects to follow this procedure when a conventional type valve is used since the larger sizes require approximately five minutes to close.

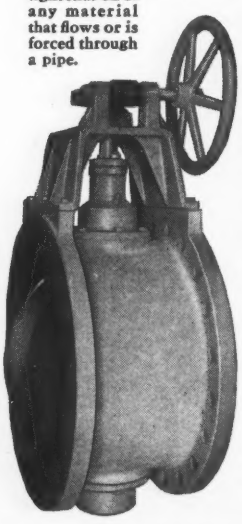
Compare this with the operation of an R-S Butterfly Valve which *requires only six revolutions of the handwheel for complete closure or opening.* It requires only a few seconds of an operator's time and he has no excuse for not performing this important operation before starting a pump when R-S Butterfly Valves are installed.

Burned-out motors at start-ups can be practically eliminated.



Comparatively light in weight, R-S Butterfly Valves effect a considerable saving in installation cost since less space and supporting structure are required. Pressures to 600 pounds and sizes to 84 inches.

The vane closes at the correct angle for the wedge-tight shut-off of any material that flows or is forced through a pipe.



BUTTERFLY VALVE DIVISION

R-S PRODUCTS CORPORATION

4535 Germantown Ave. Philadelphia, Pa.

Write for catalog No. 10-B and detailed information.

R-S Streamlined BUTTERFLY VALVES

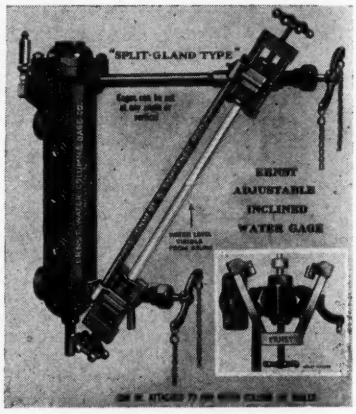
NEW EQUIPMENT

(Continued from Page 126)

Split-Gland Water Gage

By a new, self-opening gland construction that eliminates gage glass packing nuts, the Ernst Split-Gland adjustable water gage announced by Ernst Water Column & Gage Co., Livingston, N. J., makes it possible to change a broken glass in about one-fifth the time ordinarily required.

A simple turn of a hand-wheel with ample leverage, opens it wide so that the glass may be readily lifted out and the new one inserted—then a turn of the



same wheel closes it again; secure, leakless, and without developing torsional strains. A precision alinement and stiffener-rod makes possible setting at any desired angle, or in vertical position.

Available in three types, for pressures up to 300 lb., up to 450 lb., and from 450 to 600 lb., with tubular gage-glasses; also with forged steel construction for flat gage glass inserts for 1500 lb. W.S.P.

New Gage Gearing

Certified Gauge & Inst. Corp., Long Island City, N. Y., has developed, for use in pressure indicating gages, a new and improved type of gearing in the form of a patent cam and roller movement. This movement employs a sector-shaped driving cam and a driven helical roller. One end of the pivoted cam is linked to the tip of the Bourdon tube, while the other end is alined with and fits freely into the thread of the roller.

Unique with the Certified Gages is a recalibrating mechanism by means of which it is possible to reset the pointer to zero to correct any drift or set of the Bourdon tube. A back adjustment screw is available on all large gages, and effects

NATIONAL POWER SHOW

geared for war, this year at

MADISON SQUARE GARDEN

The U. S. Army has taken over the exposition floors of Grand Central Palace, familiar home of the National Exposition of Power and Mechanical Engineering. The Exposition therefore will be staged this year in the Exposition Hall of New York's famous Madison Square Garden.

With ample space for all exhibits, every convenience for visitors, central location and complete facilities for all operating demonstrations, the Exposition will be a potent factor in helping to win the war.

NEVER BEFORE HAS THE POWER SHOW BEEN OF SUCH VITAL IMPORTANCE

War has brought its own special problems to industry . . . and engineers are carrying their full share of responsibility for finding the answers. The engineering press is helping mightily, but no matter how careful your reading may be, there's no substitute for first-hand observation, demonstration and down-to-earth conversation, face-to-face with qualified experts in specialized fields!

Your visit to the 1942 Power Show will bring you benefits limited only by the time you spend there. You can personally learn about available products and newest methods. You can discuss these with technical representatives of America's most progressive manufacturers. They are devoting their time to helping you solve the problems created by war.

This year, of all years, be sure to come—and bring your associates.

See how . . . hear how . . . learn how . . . at the

15th NATIONAL POWER SHOW

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING

Nov. 30-Dec. 4, 1942, Madison Square Garden, New York

Managed by International Exposition Co.

...the "MEGGER" Tester is *ALWAYS READY* for use

When the need arises for emergency insulation testing of electrical equipment—it calls for immediate and positive action. "Megger" Insulation Testers are *always* ready for use, day or night, even in the most remote, isolated, inaccessible locations. The self-contained hand-cranked generator is a source of power that is reliable and wholly independent of any battery or other outside source. The "Megger" Tester is a complete unit in itself.

For occasional use, for periodic tests and for emergency tests, your "Megger" Tester is *always ready.* If you do not have full information on how to use and operate "Megger" instruments, write immediately for a free copy of the Pocket Manual of "Megger" Practice, No. 1420-PE.

JAMES G. BIDDLE CO.
1211-13 ARCH STREET • PHILADELPHIA, PA.

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.
Insulation Testers, Ground Testers and Ohmmeters

positive recalibration without the necessity of opening the case or removing the gage from service. In fact, the adjustment can be made while the gage is operating under pressure.

Vernier-Set Timer

RECENT design improvements have increased performance characteristics on the Series 2800 Vernier-Set Timers which are now accurately controlling machine and process operations in varied applications.

The standard built-in features of Telechron motor, simple knob setting without locking device, use of vernier scale for micro settings, 3/8 in. fine silver contacts, and hand adjustments to slides and bridges for changing operating functions in the field are now augmented with: One piece molded bakelite terminal block accommodating all external wiring to clearly marked screw post terminals, as well as bridge positions for easy selection of desired arrangement; leaf-spring contact for positive make-break action;

timer and load circuits are now wired independently on all types; but, timer and load circuits can be wired together by simply placing an external jumper across L2 and C terminals; and Flaminol and special flexible wiring employed throughout.

These timers are available in two types, normal-clutch-action for resetting upon power failure; and, reverse-clutch-action for non-resetting on power failure. Dials may be selected from 15 sec. to 60 hr. This timer is frequently supplied interwired with one or more other timers, or with auxiliary equipment, mounted in a common case to carry out process schedules or handle loads in manners not provided by one timer. Standard units may operate from 110 or 220 v., 25, 50 or 60 cycles. Load contacts are rated to carry 25 amp. at 110 v., a. c., non-inductive.

Carbon dioxide fire extinguishers and extinguishing systems manufactured by Walter Kidde & Co. and previously known as Lux, Luxomatic, Selex, etc., will henceforth all be labeled Kidde. Sole exceptions are the Rich and Richaudio marine detecting systems. In line with wartime conservation of scarce materials, the Kidde label is being made of steel instead of brass, and is narrower than the previous Lux label.

HELP FOR MEN WITH VALVES TO REPAIR

Newest "PIPING POINTERS" *Show How To Do It!*

TO keep pipe lines flowing and war production humming—now when piping replacements are hard to get—means that valves must be kept in proper repair. The latest "Piping Pointers" Bulletin answers dozens of questions on "how to do it!" Coming from Crane—America's largest manufacturer of valves—you can be sure the information it gives is sound and practical.

Not only does Bulletin No. 5 tell *how to do it,* but illustrates modern valve repair methods with actual photographs. It's a valuable reference for any piping man—*veteran* or *beginner;* ideal for employee training school use. It serves a dual purpose: (1) to help get renewed life from valves, (2) to conserve critical materials.

"Piping Pointers" Bulletins are one of the ways Crane Co., as the leader in its field, is sharing its basic information with other industries producing for Victory. Copies of Bulletin No. 5, and preceding issues covering other subjects of piping maintenance, are available *free* to any plant. Ask your Crane Representative or write direct for them.

CRANE

CRANE CO., GENERAL OFFICES:
836 SOUTH MICHIGAN AVENUE, CHICAGO
VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

TIME IS UP....

but not for the average

WARREN PUMP

many of which go on indefinitely after their "life expectancy" span. The reason: Warren never compromises with sound engineering principles, cheapens at the expense of reliability, barters safety for price advantage or recommends along the border line.

These brief case histories are typical of Warren Pump longevity:

June 15, 1901 . . . A Warren Horizontal Duplex still doing duty with a Coast Guard Unit.

November 28, 1899 . . . A Warren Horizontal Duplex Pump originally sold a municipality but of late years in service at a rendering company.

October 2, 1899 . . . A Warren Duplex Pump still on duty at a Connecticut brass works.

1901 and 1911 . . . Two Warren Hydraulic Pumps still on the job at a Pennsylvania cork products manufacturer.

1924 . . . Two Warren steam-driven vacuum pumps on duty for past eighteen years, 24 hours a day, 365 days a year.

Warren also manufactures a complete line of Centrifugal Pumps.

WHATEVER type of Warren Pumps you select, you can be sure of getting dependability and long life.

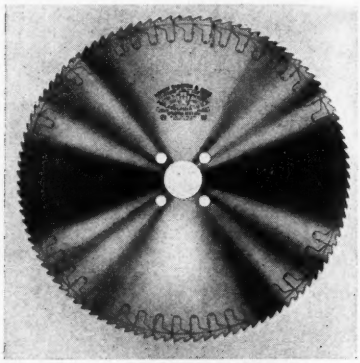
WARREN PUMPS

Warren Steam Pump Co., Inc., Warren, Mass.

Inserted Section Saw

HENRY DISSTON & SONS, INC., Philadelphia, Pa., recently introduced their new Inserted Section Saw. It combines the advantages of both the inserted tooth type and solid tooth type and is a continuous rim saw with inserted sections rather than inserted teeth that can be readily sharpened on an automatic grinder. It can be operated at speeds up to 5000 f.p.m. This design permits a thinner blade and cutting edge thus making a narrower kerf which in turn means less power required to drive it.

The design of the inserts is such that the cutting load is transmitted from each insert directly to the blade approximately at right angles to the resultant force, and not to adjacent inserts or to the rivets.



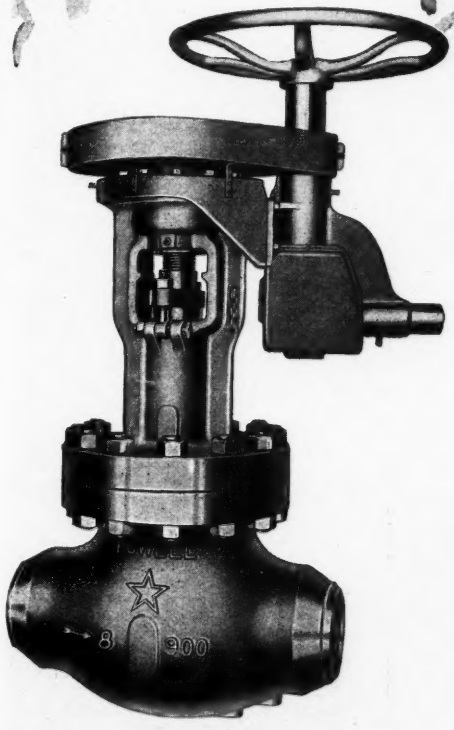
The full thickness of the blade extends to the extreme diameter, thus giving maximum support to the inserts and at the same time permitting long life without cutting into the projections when sharpening. The inserts are quickly and easily replaced should they be damaged by an accident, and can be repaired in the user's own factory or at some nearby saw repair shop.

Electrical and Oil Fire Extinguisher

DESIGNED for use on both electrical and oil fires, the Alfite carbon dioxide engine, manufactured by the American-LaFrance-Foamite Corp., Elmira, N. Y., is also equipped with an Anti-Statik horn to protect the operator from static charge. Also designed for perfect balance at wheeling height, it has a third swivel wheel for easy maneuvering, and

a retaining latch which releases horn instantly, yet holds it firmly in place when not in use.

Non-corrosive, non-poisonous and odorless, it is recommended for fires in flammable liquids, alcohol storage, electrical machinery, and for other class "B" and "C" fires. It smothers fire with carbon dioxide gas which expands upon discharge to 450 times its stored volume.



This Powell 8-inch, Class 900 pound, welding end Globe Valve meets every demand of the modern power plant for equipment to handle higher steam pressures and temperatures. Made of cast steel, with seats and discs hard faced with Stellite, it is designed for 900 pounds W.S.P. at 900 F. Anti-friction bearing yoke and gears provide quick, easy operation. Handwheel is mounted on top, and an extension stem can be provided at side for remote operation.

THROUGH long and intensive training, thousands of young American pilots are daily learning the "unerring control" that is already making our Air Force a deadly menace to the enemies of our Country.

And through nearly five generations, the men of Powell have been in training to make the valves that are so important in the production of the planes themselves and of the gas and oil to "keep 'em flying." For in every plane are assembled the results of many and varied manufacturing and fabricating processes. In each of these processes, valve control—unerring control—is a vital necessity.

As a result of nearly a century of practical experience and scientific achievement, POWELL Valves are meeting every day the most exacting requirements of our stupendous program for Victory.

The Wm. Powell Company
Cincinnati, Ohio

POWELL VALVES

Supervised Boiler and Condenser Cooling System Protection at Moderate Cost!

We believe the true answer to your boiler water and condenser cooling system problem lies in competent supervision of water conditions by experts plus a simplified natural method of water correction. Our new Technical System does just that! Scheduled supervision and treatment based on frequent water analysis finds and remedies your trouble . . . specific organic formulas developed individually to fit your needs provide a simplified, natural correction. Send the coupon below for the new Technical System bulletin or have a Water Treatment Company engineer inspect your plant without obligation.

WHY NOT SEND THIS COUPON *NOW?* . . . *to*

American Radiator & Standard Sanitary Corporation

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or send to

☐ Please send the new Technical System bulletin.
☐ Have a Water Treatment Company engineer call.

Name ..... Title .....

Company .....

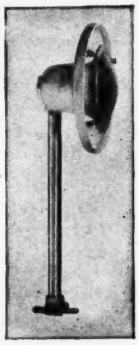
Address .....

WATER TREATMENT COMPANY of America

Blackout Luminaire

GENERAL ELECTRIC's blackout street luminaire, redesigned to meet the revised specifications for American outdoor blackout lights, is said to provide a lighting intensity equivalent to 1/50 of the illumination of a full moon.

To eliminate likelihood of breakage from shrapnel or flying particles during an air raid, the unit has been built without glass and employs only plastics



and iron. Light is supplied by a 9-watt long-life lamp placed in a plastic band. The luminaires are equipped with brackets, and can be installed either on buildings or on wood poles.

Blackout street luminaires, spaced from 100 to 150 ft. apart, are expected to be used mainly in areas where blackouts may hold up production for war or military movements. In such cases, they will be installed on streets leading directly to war production factories or other vital war areas. Because of the low-wattage, long-life lamp employed, the luminaire may be operated 24 hr. a day at low cost and be always in service when the blackout alarm is sounded.

Welding Electrode

A NEW arc welding electrode, designed to add more speed to arc welding in war production, is announced by the Lincoln Electric Co., Cleveland, Ohio.

The new electrode, known as Fleetweld 11 is created especially for use with Fleet-Fillet technique of arc welding, recently announced by the company. The electrode is designed to obtain maximum benefit in speed of welding from the new technique.

Fleetweld 11 in addition to being a fast flowing electrode is said to give deeper penetration of metal into the root of the joint. It is shielded arc type and heavily coated to exclude oxides and nitrides from the weld, thus assuring the high quality of weld metal characteristic to the shielded arc process. Faster welding is permitted and also the operator is enabled to do more work without fatigue.

High Temperature Resistant Coating

CARBOZITE high temperature resistant coating is a new specialized coating developed by the Carbozite Corp., First National Bank Bldg., Pittsburgh, Pa., for the express purpose of resisting the deleterious effects of temperatures up to 2000 deg. F. This coating is said to prevent the formation of scale and oxidization when applied to metal surfaces which are subject to direct flame.

The coating is also adaptable for ap-

You can take personal pride...

in what

SWARTWOUT CONTROLS

do for the efficiency of your plant

—Safety, Low Maintenance and Consistent Performance

KEEPING a capacity-strained power plant running these days without mis-hap or outage is an achievement you can be proud of. It's never much consolation to place the blame for break-downs on equipment that may not have been able to stand the punishment. • Just as you power engineers gain enviable reputations based on performance and experience, so Swartwout Power Plant Equipment is called for more frequently than ever as new records are made in years of trouble-free service — consistent service that is practically without maintenance expense. • Simple design, rugged construction, easy adjustment features make Swartwout Controls constantly dependable. They're serving faithfully in thousands of plants today.

The Swartwout Co.
18541 Euclid Ave., Cleveland, Ohio

Feed Water Regulation
Nearly 600 complete Swartwout Feed Water Regulators chosen for critically important sea service
Pressure Control
Swartwout Controls help you keep profitable power service flowing
with Safety Efficiency and Economy
Feed Water Heating
Swartwout Standard Heaters engineered to your needs
Liquid Level Control
"Duplicate Previous Order" spells SATISFACTION with these Swartwout Liquid Level Controls
Reducing and Desuperheating
You can bank on safe, rigidly controlled steam temperatures with Swartwout Desuperheaters
Separation
Whirl the costly hazards out of your steam with Swartwout Separators
Positive separation, without pressure loss

Swartwout

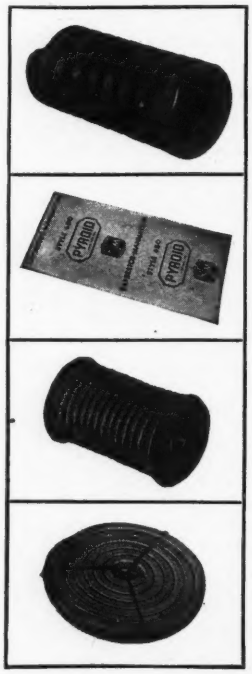
•Power Plant Equipment•

"Hold that line!"..with R/M PACKINGS

Steam lines, oil lines, air lines, fuel lines . . . all must operate under higher pressures today as production calls for speed and more speed. R/M packings are made to Hold That Line, up to the limit beyond which no machine or material can be pushed.

R/M engineers are constantly testing and re-testing to prove and improve, so that R/M packings *can* take it, *can* meet the stepped-up strains and stresses of production for all-out war. R/M means Raybestos-Manhattan. R/M means Reliable Materials.

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy of this catalog from your R/M distributor, or write us direct.



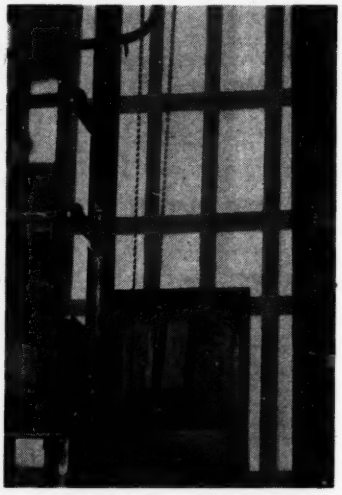
INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

plication on the inside of fire walls to prevent the spalling of mortar and brick. When the coating is subjected to temperatures of 1000 deg. F., it will fuse to the surface on which it has been applied and forms a vitreous protective coating. When so fused, it is resistant to the effects of acids and alkalies.

Two applications of the coating are recommended for all installations. Each coat will dry hard within 3 hr. Approximately 150 sq. ft. per gal. can be covered on the first coating, while the second coat will give 200 sq. ft. per gal. The coating is available in various colors; however, the red and green coatings retain their true color after prolonged heating.

Exterior Finish for Suspended Arches and Walls

THE M. H. DETRICK Co., 140 S. Dearborn St., Chicago, Ill., has developed a hard surface exterior finish for their suspended arches and walls. Following development, trial and experimental installations of this finish have been in operation for about 3 yr. on furnaces exposed to the weather, and are said to have proven very satisfactory. This finish is air tight, heat tight, and weather



proof. It takes the place of steel casing or asbestos board casing and presents a pleasing appearance. It is shipped dry and mixed on the job. For a suspended wall consisting of fire clay tile supported by castings and block insulation 1 in. of the hard finish material is applied with a trowel. The wall castings break the hard finish up into panels and also reinforce it.

Swivels for Stationary and Moving Surfaces

TRABON ENGINEERING CORP., 1814 E. 40th St., Cleveland, O., has recently introduced a new line of straight and 90 deg. angle swivels for use in making oil, grease, air and other line connections between stationary, and revolving, oscillating or other moving surfaces.

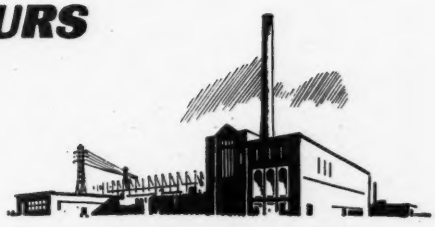
These swivels are available in two different constructions for different requirements. The standard ball bearing swivels are available in ⅛, ¼, ⅜, ½,

GUARD THOSE VALVES OF YOURS

New valves will be *harder* to get—even if you work directly for the war effort.

There are not sufficient materials for valves—or wear resisting parts. Allocation will reduce, still further, amounts valve manufacturers have been able to obtain for lower ratings. And control is directing the uses to which all valves are shipped.

Too few of us have the feel of this war—yet. But, it is our belief that those who need continued operation of valves will be well advised to adopt conservation and substitution right now—as part of the price loyal citizens pay for a victorious war. It is no whit smarter to try to find "angles" by which materials needed for active war can be diverted to our plants than it is for a commander in the field to withhold an order to fire—to save his own hide.



READING-PRATT & CADY

MANUFACTURERS OF

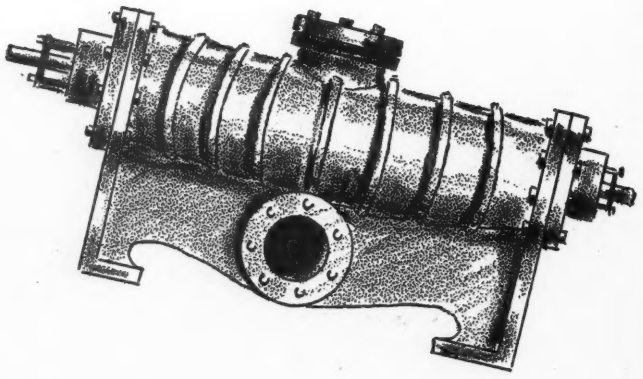
R CAST STEEL VALVES P&C BRASS AND IRON VALVES

D'ESTE ENGINEERING SPECIALTIES

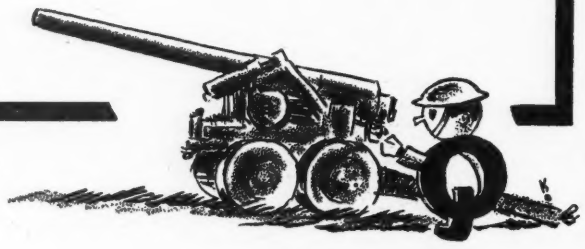
Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF **AMERICAN CHAIN & CABLE COMPANY, INC.,** BRIDGEPORT, CONNECTICUT

Fire Power—



for Industry



FIRING boilers is just as important as firing bullets in a war of production, and Quimby Screw Pumps are providing positive flow of fuel to American industry that will mean final victory.

Quimby Screw Pumps are silent in operation and require a minimum of attention, but their effectiveness is contributing substantially to ultimate success of Allied guns, planes, tanks and ships.

THE BEST PUMP FOR THE JOB—
IS THE MOST ECONOMICAL PUMP TO USE!

QUIMBY PUMP COMPANY, INC.
352 Thomas Street, Newark, N. J.

QUIMBY PUMPS
Better Pumping Practice
SINCE 1894

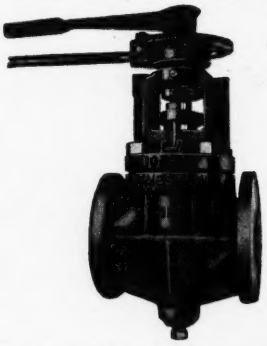
¾ and 1 in. pipe sizes. Due to the ball bearing construction, these swivels turn freely at any pressure without binding.

Light duty swivels built without ball bearings are intended for use only in lighter work when space limitations do not permit the use of standard ball bearing swivels and are offered only in ⅛ and ¼ in. pipe sizes.

Both standard ball bearing and light duty swivels are furnished regularly with right hand threads in both head and stem. Swivels with left hand threads in either the head or stem, or in both head and stem—and swivels built from special materials for handling corrosives, etc., are also available.

Plug Valves

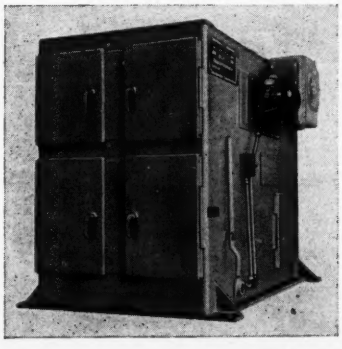
HOMESTEAD VALVE MFG. CO., Coraopolis, Pa., has announced a new line of Lever-Seald plug valves for 150 lb. working pressure and size range from 1½ to 10 in., in either semi-steel or steel. Face to face dimensions of each valve in the new line are the same as those of the



corresponding size of wedge-gate valve. They are also said to be instantly interchangeable with wedge-gate valves, without piping changes. A strong leverage provides extra-easy opening or shut-off under various conditions.

Automatic Coal Scale

IN THE DESIGN of the new Seco coal scale, the Stock Engineering Co. of Cleveland, O., has included such features as dust seals, accessibility to all major elements, all-welded housing, simple electric control circuits and mechanical design. The belt conveyor is of the endless type, to insure long life and



uniform feeding, and has integral flanges to prevent spilling. The weigh hopper is made of chrome stainless steel, butt welded. Careful design prevents arching of coal either in the scale inlet or in the downspouts to the inlet. The

WeldELLS *have everything*★

For example:

Size and Thickness Marked on Every Fitting

WHEN we say "WeldELLS have *Everything*", do we mean they're beyond improvement? Of course not; nothing is, or ever will be. We simply mean that in their design and manufacture every feature has been incorporated which, up to this writing, has been found conducive to better, safer, faster welding and a stronger piping job.

How do you know this to be true? Because you find, when you compare them with other welding fittings, that they have everything *any* fitting has and some features that no other fitting has!

Some of these features are based on engineering considerations that contribute *directly* to the strength of the finished piping installation. Others have convenience and economy in mind. They speed up the work and cut costs. But in the last analysis they, too, contribute to soundness by making it easier for the welder to do the job right.

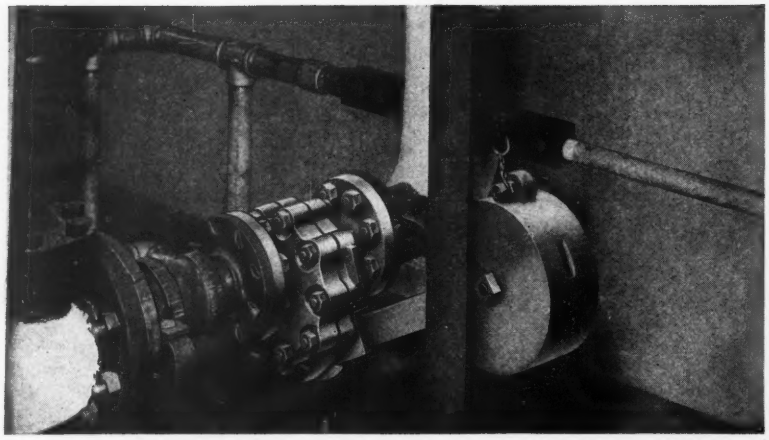
An example of this is illustrated here. These complete identifying markings on every Taylor Forge Fitting eliminate the guess-work—the searching—the miking—the danger of using wrong thickness. Add this feature to those listed opposite and you'll know why WeldELLS mean better and more economical pipe welding.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

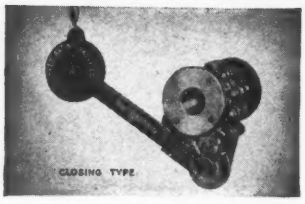
★WeldELLS alone have all these features

In addition to the feature described, they include:

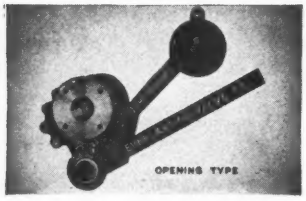
- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the world**—insures complete service and undivided responsibility.



VALVES . . . *that operate instantly . . . unfailingly* FOR FIRE PROTECTION



CLOSING TYPE
For emergency shut-off of the flow of inflammable liquids or to concentrate water or steam on fire mains. Sizes 1-in. to 8-in.



OPENING TYPE
For diversion of water to sprinkler deluge or water curtain systems or to divert inflammable liquids to a point of safety. Sizes 1-in. to 8-in.

Both types may be controlled thermostatically, electrically, or manually from any or many sources.

Everlasting Valves, weight-operated with pendulum stop, are expressly suited to fire protection service. These positive-acting, thoroughly reliable valves are widely used on foam systems, sprinkler systems, fuel line shut-off, dip tank discharge, enamelling tank discharge, electric generator protection, and similar services.

FEATURES

WILL NOT STICK . . . because made of materials which will not corrode under working conditions.

WILL NOT BIND . . . because there is no external stuffing box that might be improperly packed.

WILL NOT WEDGE . . . because disc travels in a line parallel with both interior of upper bonnet and seat.

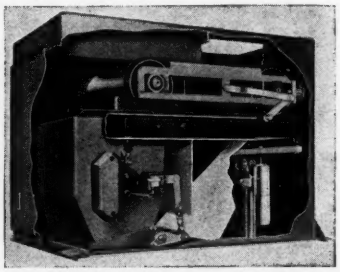
WILL NOT CLOG . . . because straight-through design permits full, unimpeded flow.

Ask for Bulletin E-52B

EVERLASTING VALVE COMPANY
49 FISK STREET **JERSEY CITY, N. J.**

Everlasting Valves
for everlasting protection

driving motor is of a standard totally enclosed type, provided with a specially designed shoe brake and drives the unit through a separate gear reduction element, all being equipped with ball bearings. Control of the motor is accomplished by means of one standard motor starter mounted on a panel in a dust tight control cabinet. A by-pass operated by means of a conveniently located lever is provided to be used in case of electrical failure.



In operation as the coal is being discharged from the scale, the swing bottom of the weigh hopper closes when it is freed by the diminishing coal pile. This action closes the interlocking switch on the side of the hopper, causing the feeder drive motor to start and the electrical latch to lock the hopper bottom in the receiving position.

Coal is then fed by the conveyor until the weigh hopper balances the beam; a mercury switch operated by the beam then interrupts the control circuit and the motor is stopped by a solenoid operated brake; simultaneously, an electrically operated latch on the hopper is released and the bottom falls open under the weight of the coal. This cycle may be repeated as often as twice a minute. A compensating device is provided to allow for the coal in mid-air at the time the weigh hopper balances the beam which insures accuracy in recorded weights.

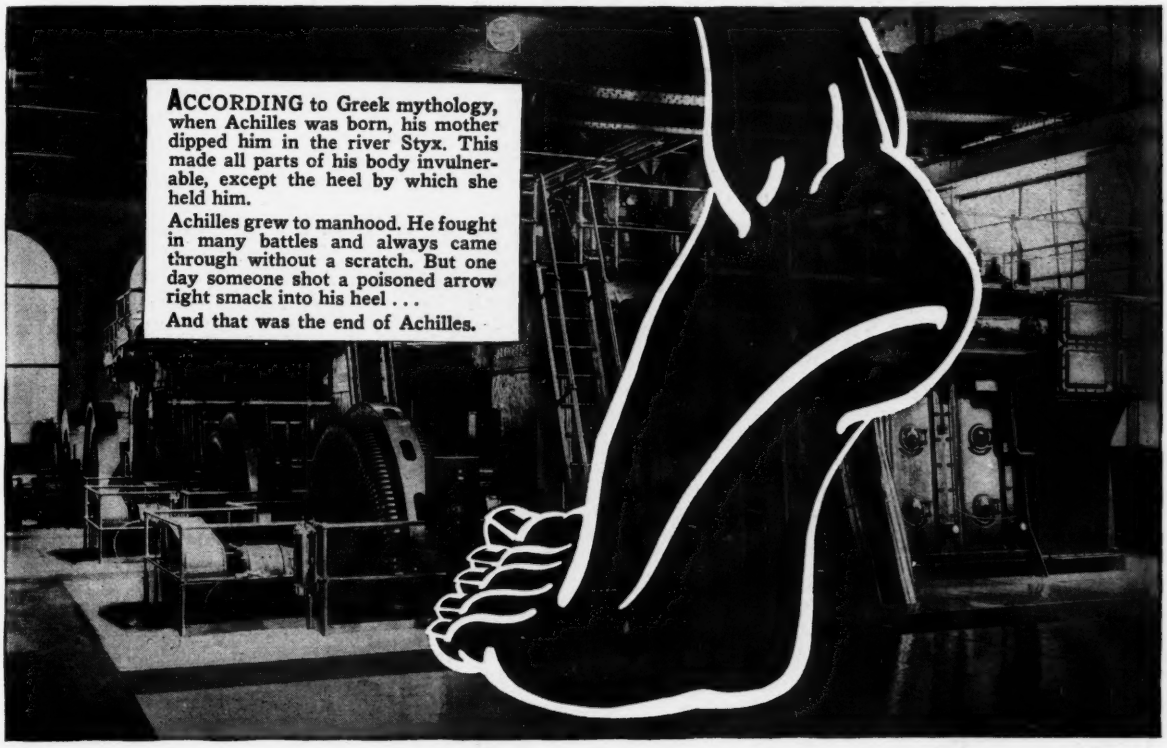
MANUFACTURERS' PERSONALS

William N. Grooms, Salt Lake City, Utah, has been appointed district sales agent as announced by W. R. Swoish, vice-president of the Roller-Smith Co., Bethlehem, Pa. Mr. Grooms will handle all Roller-Smith products in the States of Utah, Idaho, Montana and the southwest corner of Wyoming, and will maintain offices at 630 Dooly Block, Salt Lake City.

J. M. Lang has been appointed accountant of the Electronic Tube Division of the General Electric Radio, Television and Electronics Department with headquarters at Schenectady, New York, as announced by E. L. Hulse, Auditor of the Department. Mr. Lang formerly was a war projects accountant in the accounting department of the company.

Thomas Matchett, president of Robins Conveying Belt Co., Passaic, N. J., has been appointed to the Conveyor and Mechanical Power Transmission Industry Advisory Committee of the

Remember the story of Achilles' Heel?


ACCORDING to Greek mythology, when Achilles was born, his mother dipped him in the river Styx. This made all parts of his body invulnerable, except the heel by which she held him.
Achilles grew to manhood. He fought in many battles and always came through without a scratch. But one day someone shot a poisoned arrow right smack into his heel . . .
And that was the end of Achilles.

There's a moral in it for every Diesel Engine Owner!

Your Diesel engine has its own Achilles' heel.

It's the need for proper lubrication.

Without proper lubrication your Diesel is vulnerable. A burnt-out bearing may hold up production indefinitely. That means precious man-hours lost, schedules delayed, and a costly repair bill for you to pay.

These days, with quotas going up . . . with engines driving longer and harder than ever . . . and with Diesel parts almost impossible to replace — you cannot afford to take chances with makeshift lubrication. *Continuous, efficient operation demands a lubrication plan designed for your particular job!*

That's where a Cities Service lubrication engineer can be of great help to you. He knows what you're up against, and he has the necessary "know-how" and special instruments to tackle the job scientifically.

There's no charge for this friendly consultation. Simply phone or write the office nearest you.

An informative booklet, "Diesel Engine Lubrication," is yours for the asking. Just check the space indicated.

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.
or any of the following offices:
CHICAGO . CLEVELAND . ST. PAUL
KANSAS CITY . BOSTON . TORONTO
or to
ARKANSAS FUEL OIL COMPANY
SHREVEPORT . ATLANTA . BIRMINGHAM

Please send me your booklet, "Diesel Engine Lubrication." ☐ P. P.

Name_____

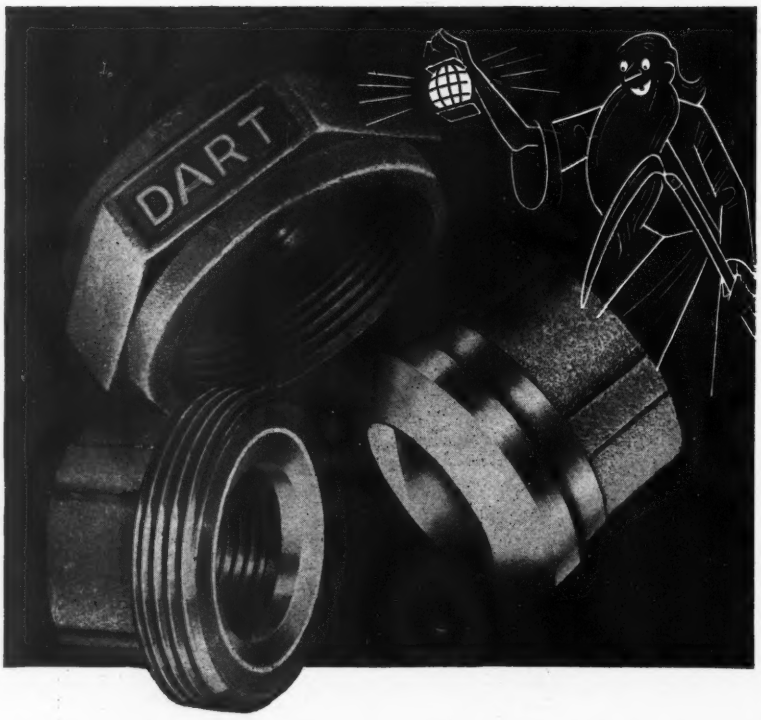
Firm Name_____

Address_____

City_____ State_____

A LUBRICANT FOR EVERY INDUSTRIAL NEED

SCRAP PILES are "GOLD MINES" if they have Discarded Darts



...You Really Find something when you find Used

DART UNIONS

Just a pile of pipe scrap? Wait a second . . . take a *good* look! That scrap may contain some discarded Dart Unions—and if it does, your company is in luck . . . and the cause of metal conservation gets a good break, too. *Those discarded Darts can be put back on the job.*

Just because a Dart has seen a lot of service doesn't mean that it's through. Far from it! Dart Unions can be used again, again and *again*, giving trouble-free tightness each time. For this unusual performance, credit Dart's matched bronze seats, ground to "true-ball" surfaces . . . and the fact that Dart's air-refined malleable iron nuts and bodies resist corrosion, rust, rough handling.

It's good business and practical patriotism to team up your old Darts with the new ones available from your supplier.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

WPB. The company also announces the election of three additional vice-presidents: R. W. Eichenberger and E. C. Salzman, of the home office, and J. F. Meissner who remains as manager of the Chicago office. Harold VonThaden continues as first vice-president. Mr. Salzman and Mr. Eichenberger have been with Robins since 1910 and Mr. Meissner since 1916.

Worthington Pump and Machinery Corp. announces the appointment of R. J. Laidlaw to the position of manager of its Cleveland district office. Mr. Laidlaw will succeed A. J. Klug who will devote his entire time to special work with important industries in the Cleveland district. Mr. Laidlaw has been connected with the Worthington organization in various capacities since his return from overseas in 1919.

Dr. J. Mitchell Fain has been granted a leave of absence for the duration from his duties as chemical engineer at Foster D. Snell, Inc., consulting chemists-engineers of Brooklyn, N. Y. Major Fain has been called to active duty in the Chemical Warfare Service and is stationed at the Chemical Warfare School, Edgewood Arsenal, Md. Prior to being called on active duty he was engaged in chemical engineering work connected with the processing of strategic metals. Recent additions to the staff of Foster D. Snell, Inc. include Norman Fine, B.Ch.E., Cooper Union, Alvin Gruder, B.S., Long Island University, Anne Sullivan, B.A., Adelphi College and Herbert Terry, B.S., College of the City of New York.

R. A. Schoenfeld, vice-president and sales manager for Wheelco Instruments Co., Chicago, Ill., has announced three recent appointments to the company's sales and service organization. C. L. Clark, of Westinghouse Elec. & Mfg. Co. for the past 13 yr., recently as control specialist at the Cincinnati office, has been attached to the Cleveland office as sales engineer. Robert N. Miller, for the past 7 yr. sales and service engineer for Mercoid Corp. in Chicago, is now service engineer at the Cleveland office. Howard B. Jones, formerly with McGraw-Hill Publishing Co., has been employed as sales and service engineer at the Chicago office.

Roy M. Smith has joined the Roller-Smith Co., Bethlehem, Pa., as assistant chief engineer. Mr. Smith comes from the Bryant Electric Co., where he was engineering manager for the Wiring Device Division. Prior to this, he was with the Westinghouse Elec. & Mfg. Co. as section engineer on relay design and application. A graduate from the University of Washington, he will devote the majority of his time to design and application of the company's products. He is also a member of the A.I.E.E.

Chester W. Smith has recently joined the staff of the Detroit Rex Products Co., Detroit, Mich., as research chemist in the Alkali Division. Mr. Smith, a member of the American Chemical Society, has been in the field of electrochemistry as applied to electroplating for the past 8 yr. He was formerly affiliated with the J. C. Miller Co. as chief chemist working on research and development of materials for the field of electroplating.

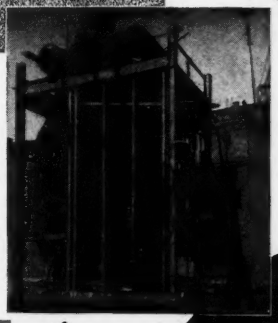
Vogt

PRODUCTS ARE

★ DESIGNED to RAISE
★ OPERATING STANDARDS and
★ LOWER YOUR COSTS

Drop Forged for Safety and Economy under the Most Trying Conditions

Valves, Fittings and Flanges by Vogt—the choice of operating men everywhere for safe and sure regulation of the high pressure and high temperature liquids and gases used in modern process work.



High Operating Efficiencies and Low Maintenance Costs

More steam per dollar of investment—because Vogt steam generating equipment is designed and built to fit in with specific operating conditions. Vogt boilers are available in bent tube types and straight tube, forged steel sectional header types for solid, liquid, or gaseous fuels, as desired. Three-drum types can be supplied to fit any conditions of restricted installation space.

Meeting the Demands for Operating Security

Vogt has every facility for the fabrication of stills, towers, continuous rotary filters, filter presses, oil chilling machines, heat exchangers, etc., and these products are serving the petroleum industry around the world.

Vogt
PRODUCTS

For Oil Refineries, Chemical Plants, Power Plants and Related Industries

☆

HENRY VOGT MACHINE CO.

LOUISVILLE, KENTUCKY

NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

To Combat Corrosion and Product Contamination

Process equipment made from special metals and alloys for the exacting service of the chemical plant is fabricated in our modern shops for many of the well known chemical companies.

Steps Tonnage Up and Costs Down

Our experience of more than 50 years in building profit-making ice and refrigerating machinery is at your command. We make complete units for ice and cold storage plants, packing plants, dairies, breweries, chemical plants, oil refineries, etc.

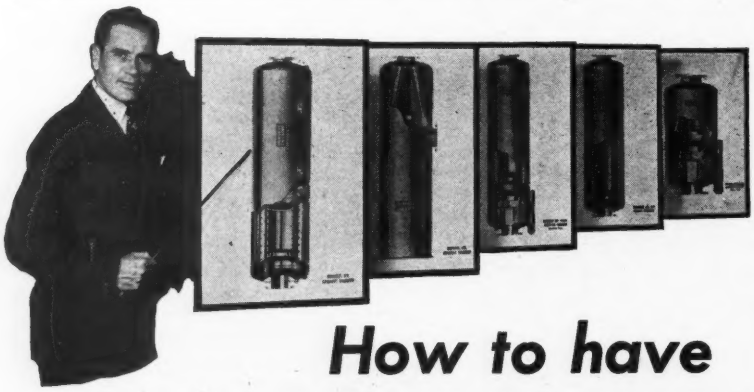
W. E. Silvus was recently appointed engineer of the General Electric Co.'s Houston local office, as announced by A. E. Allen, District Manager.

Mr. Silvus has been with the company's engineering department in the Southwest District since 1926. He was graduated from Texas A. & M. in 1922, and entered the G-E Test Course in the following year.

G. R. Bryant, formerly with the Lighting Sales Section of the General Electric Lighting Division at Schenectady, has been named G-E lighting specialist for Western New York State, with headquarters at Buffalo. He succeeds the late J. E. Schell, who died August 1, shortly after his retirement.

A graduate of Purdue University, Mr. Bryant entered the General Electric Test Course in 1939 and in 1940 he joined the Lighting Division, where he has been active in the sale and promotion of street lighting, floodlighting and traffic signals.

James S. Hagan of La Grange, Ill., has been appointed manager of the Northwestern District of the Westinghouse Elec. & Mfg. Co. district manufacturing and repair department. He succeeds R. E. Powers, now serving as Pacific Coast District manager of the department. In his new position Mr. Hagan will supervise repair and manufacturing activities in a territory that embraces all or parts of nine states.



How to have
QUIET EXHAUSTS
on Diesel Engines

Sectional view of Burgess STC Exhaust Snubber.

There was a time when Diesel engines meant loud and objectionable exhaust noise. This is no longer true. Now Diesel exhausts operate quietly in municipal power plants, industrial plants, hotels, office buildings, and hospitals, as well as on ships and in portable power plants of all types. Burgess Exhaust Snubbers make this possible.

Burgess Snubbers operate on the patented snubbing principle of quieting Diesel exhausts by removing the source of noise before the noise can occur. Removal of objectionable noise and pulsation is effected without impairing efficient operation of the engine. Burgess Battery Company, Acoustic Div., 2823-K W. Roscoe St., Chicago.

HOTEL—*In Grand Forks, N. D., the Hotel Dacotah operates two Snubber-equipped engines.*

MUNICIPAL PLANT—*Jasper, Texas, power plant, "deep in the heart" of east Texas.*

BURGESS
DIESEL EXHAUST
SNUBBERS

Charles A. Thompson, of the Pittsburgh office of Robins Conveying Belt Co., Passaic, N. J., also a graduate of Carnegie Tech., has become a Lieutenant in the United States Navy.

Foote Bros. Gear and Machine Corp. announce the recent addition to its contact engineering staff of Irwin A. Marshall, to represent the company in the Cleveland and Northern Ohio territory. An expert in the power transmission field, Mr. Marshall has been serving industry for the past 12 yr. in Ohio and the Central States as a sales engineer and specialist on speed reducers, couplings, and gears.

James R. Connell was recently appointed vice-president in charge of sales of The Fibre Conduit Co., Orangeburg, N. Y., as announced by H. J. Robertson, Jr., president. Mr. Connell has been a member of the board of directors of the company since 1939, and will continue to serve in this post.

Stuart E. Lauer, president of the York Ice Machinery Corp., announced the appointment of Joseph E. Moody as manager of Industrial Relations for the company. The Industrial Relations Department will be located at the West York Plant but will cover all divisions of the corporation.

Mr. Moody was born in Hartford, Conn., and is a graduate of Cornell University. He has been district representative of the WPB and the War Man Power Commission. He was also plant manager and personnel director for the Hat Corp. of America in South Norwalk, Conn.

Becker Appointed Supervisor

HUGO E. BECKER, a Westinghouse sales engineer on the Pacific Coast since 1925, has been appointed supervisor of the newly created maintenance sales department for the company's Pacific Coast District as announced by Charles A. Dostal, district manager.

Mr. Becker will co-ordinate the work of three major maintenance divisions of the company, renewal parts, field engineering and repair plants. He will also co-ordinate maintenance of existing Westinghouse equipment in the marine industry, and electric utilities, and on transportation systems.

A native of Springerville, Arizona, Mr. Becker attended the University of California and Stanford University, receiving his engineering degree from the latter in 1922.

Clouser Appointed Sales Manager

THE WILKENING MFG. CO., Philadelphia, Pa., announce the appointment of Walter A. Clouser as manager of the Replacement Sales Division.

Mr. Clouser has been a member of the Wilkening organization for 17 yr., starting as a territory salesman and progressing steadily through territory manager, division manager, assistant sales manager, to his new and larger responsibilities.

EXACT CONTROL IS *Vital*..

— to maintain consistently uniform quality in the manufacture of Globe Steel Tubes. A large and fully equipped chemical and physical laboratory, manned by graduate metallurgists, is basic to the exact control of production maintained at Globe Steel Tubes Co.

GLOBE TUBES

In addition to the most advanced machinery and methods in the mill, under the direction of a large staff of experienced engineers and technicians, the Globe Steel Tubes Co. laboratory is another important factor which contributes substantially to the inherent quality of Globe Steel Tubes . . . quality which has won them high recognition with utilities, leading railroads, industrial and marine boiler builders.

GLOBE STEEL TUBES CO.
MILWAUKEE, WISCONSIN

GLOBE STEEL TUBES

STAINLESS TUBES • BOILER TUBES • CONDENSER AND HEAT EXCHANGER TUBES • MECHANICAL TUBING . .

5000

MANUFACTURERS' NEWS

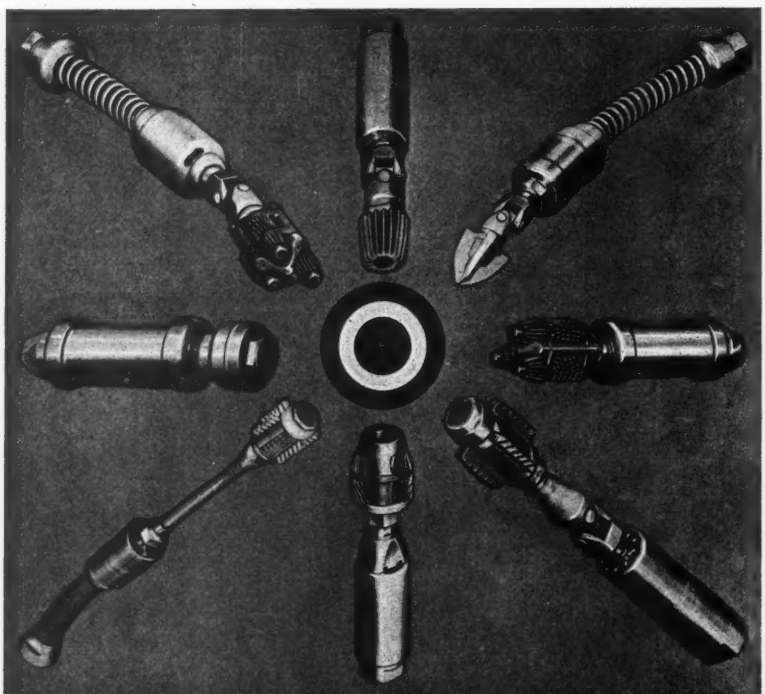
Army, Navy, Maritime Production Awards

Scovill Manufacturing Co., Waterbury, Conn., on Aug. 27 was awarded the Army-Navy "E" for production excellence.

The Goodyear Tire & Rubber Co., Akron, Ohio, on Sept. 15 was awarded an Army-Navy "E", symbolic of outstanding accomplishments in war production. The presentation was made by Major General William N. Porter, Chief of the Chemical Warfare Service in Washington. A feature of the ceremonies included presentation of "E" pins to nearly 3000 Goodyear employes.

The Byron Jackson Co., Los Angeles, Cal., was awarded the Army-Navy "E" on Aug. 21 for exceeding production records on war materials.

The Struthers Wells Corp., Titusville, Pa., was awarded the Army-Navy "E" on Sept. 9.



DON'T LET DIRTY BOILER TUBES SABOTAGE YOUR WAR PRODUCTION

Maximum plant production—never more important than at present—can be maintained only when boilers operate at *maximum* efficiency. Dirty tubes reduce boiler efficiency materially. Long or frequent shutdowns for tube cleaning are costly. Both reduce plant output.

There is a Wilson Tube Cleaner, cutter head, brush or other accessory which quickly, thoroughly and economically overcomes *any* scale or sludge condition encountered in straight or curved ferrous or non-ferrous tubes of large or small diameter.

You can quickly satisfy yourself that Wilson Tube Cleaners maintain boiler efficiency at the maximum, increase production and save tubes, time and trouble. Write for the name of our representative nearest to you or ask for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.

INVEST IN AMERICA! BUY WAR BONDS AND STAMPS!

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.

Jenkins Bros., Bridgeport, Conn., plant, manufacturers of valves, was awarded the joint Army-Navy "E" pennant on Aug. 19 for excellence of production of war materials. The award was made by Rear Admiral Wat T. Cluverius, and Lowell Thomas acted as master of ceremonies.

The Skinner Engine Co., Erie, Pa., was awarded the Army-Navy "E" award on Aug. 25 for excellence in turning out war implements for the army and navy. Col. J. J. Billo of the United States Army made the presentation which included lapel insignia for over 300 employes.

At a ceremony held in Erie, Pa., Aug. 17, the Erie City Iron Works received the joint Army-Navy "E". The presentation was made by Colonel Herbert D. Vogel, chief of the Pittsburgh Engineering Procurement District and was accepted by Frank G. Brinig, president of the company. Also, the Army-Navy "E" pin was presented to employes by Commander R. G. Walling, U.S.N., officer in charge of the Erie district.

Foster Wheeler Corp., on Aug. 17, received its second "E" for production excellence. The first award was made to the Carteret, N. J. plant in May while the Danville, N. Y. plant received the new Army-Navy award.

The Ohio Injector Co. has become one of the first companies in the valve industry to be awarded the Army-Navy "E". The "E" was formally presented at the steel valve plant at Wadsworth, Ohio, on Aug. 26.

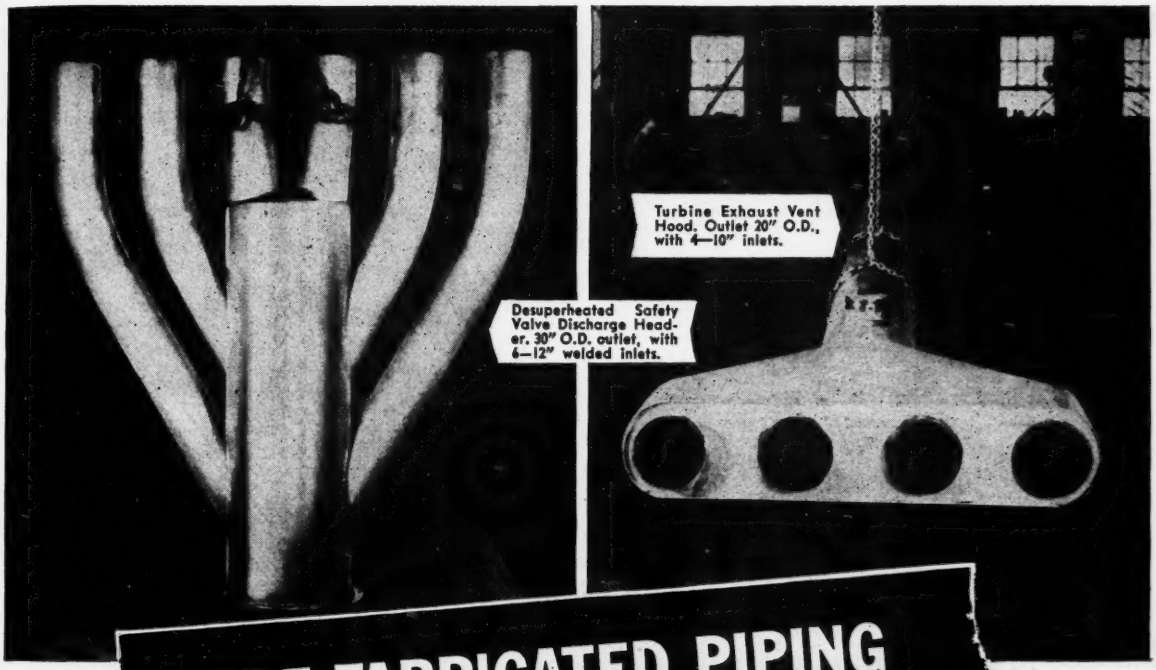
Presentation by Captain Schlabach, the Pennant was received and ackowledged by P. M. Arnall, executive vice-president of the company. Army-Navy "E" pins were presented to the employes by Lieutenant A. R. Staudt, USNR.

The Philco Corp., Philadelphia, Pa., has recently been awarded the joint Army-Navy Production Award "E". Lapel insignia were also presented to representatives of management and employes.

The Babcock & Wilcox Co., Barberton Works, on Sept. 2, received the Maritime "M" burgee in recognition of outstanding achievement to the U. S. Maritime Commission. The presentation was made by Rear Admiral Emory S. Land and was accepted by A. G. Pratt, president of The Babcock & Wilcox Co. The Maritime burgee now flies alongside the Navy "E" burgee which was awarded in May.

The Combustion Engineering Co., Inc., and its employes of the Chattanooga plants on Sept. 1, were awarded the Maritime Commission "M" Pennant, the Victory Fleet Flag and the Labor Merit Insignia for outstanding achievements in building boilers for Liberty ships and other vessels.

Selection of five Pennsylvania and New Jersey plants of the Westinghouse Elec. & Mfg. Co. to receive the new Army-Navy Award pennant "for high achievement in the production of war equipment" was recently an-



Turbine Exhaust Vent Hood. Outlet 20" O.D., with 4—10" inlets.

Desuperheated Safety Valve Discharge Header. 30" O.D. outlet, with 6—12" welded inlets.

PRE-FABRICATED PIPING

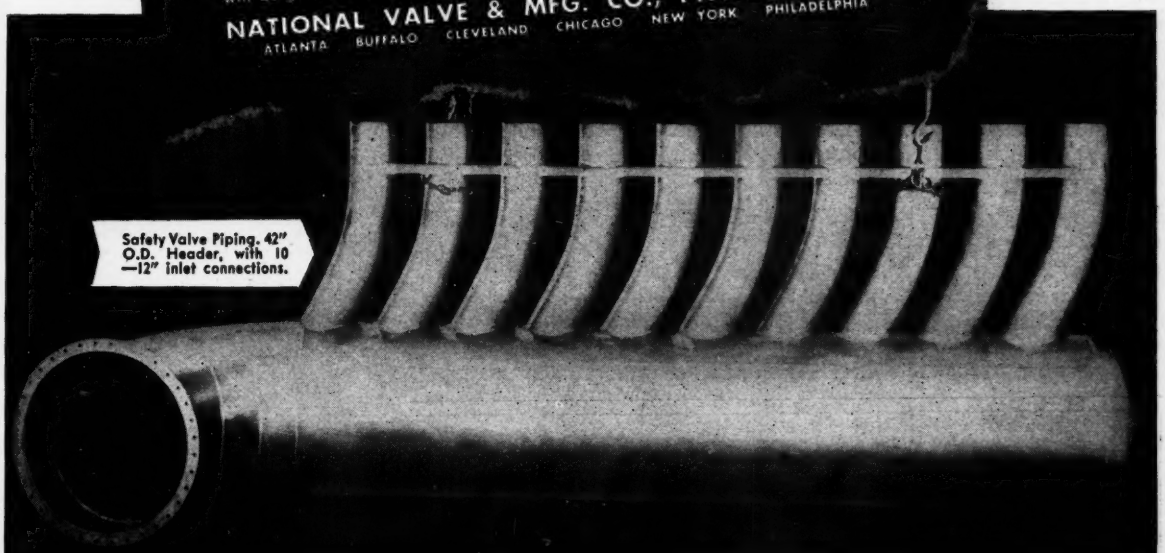
There are many advantages in shop fabricating such assemblies as shown here. Better control of welding is afforded — Economies are effected — Closer tolerances can be maintained

The extensive facilities of Navco Shops insure reasonable deliveries even in these days of Defense Programs and Priorities

Whether you require just a single pipe bend or a completely installed system, Navco will be glad to serve you.

NATIONAL VALVE & MFG. CO., PITTSBURGH, PA.

ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA



Safety Valve Piping. 42" O.D. Header, with 10 —12" inlet connections.

NAVCO PIPING

NAVCO

AS YOU PLAN FOR AFTER VICTORY
Consider the
Experience
BACK OF MURRAY EQUIPMENT

Partly assembled low pressure wheel for 2500 k.w. condensing turbo-generator. Nominal pitch diameter of the wheel is 48". View shows construction of blading used.

For more than 70 years MURRAY power plant equipment has played an important part in keeping production wheels turning.

★ Today, in cooperation with America's war winning effort, our production is being scheduled to meet high priority needs. When the day does come when a good old purchase order alone can secure equipment, we will be happy indeed to give our full cooperation to those whose priority ratings now preclude the usual prompt MURRAY Service.

In the meantime may we suggest that you send for Bulletins on Turbine-Generator Units so that you can see just what MURRAY experience means.

BOILERS TURBINES ENGINES
MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

Change of Address

To avoid missing an issue or paying for forwarding postage be sure to send a change of address to our office. Changes received by the 20th of the month can be made effective for following month's issue.

nounced by George H. Bucher, president of the company after being advised of the awards by James Forrestal, Under Secretary of the Navy. Presentation of the awards were or will be made by the Navy at the various plants between August 11 and September 10. The plants thus honored are the Westinghouse Steam Division, South Philadelphia, Pa., the Westinghouse East Pittsburgh Division, East Pittsburgh, Pa.; the Westinghouse Transformer Division, Sharon, Pa.; the Westinghouse District Manufacturing and Repair Plant, 30th Street, Philadelphia, Pa.; and the Company's District Manufacturing and Repair Plant, Newark, N. J.

Richard S. Schultz Offices and Associates, announce the establishment of the firm Methods for Industrial Relations, Inc., at 22 E. 40th St., New York, N. Y. The organization will, as in the past, render service, consultation and research in personnel and industrial relation methods suited to the changing needs of business organizations.

Hygrade Sylvania Corp., manufacturer of incandescent lamps and radio tubes and one of the largest producers in the fluorescent lighting field, recently became Sylvania Electric Products, Inc.

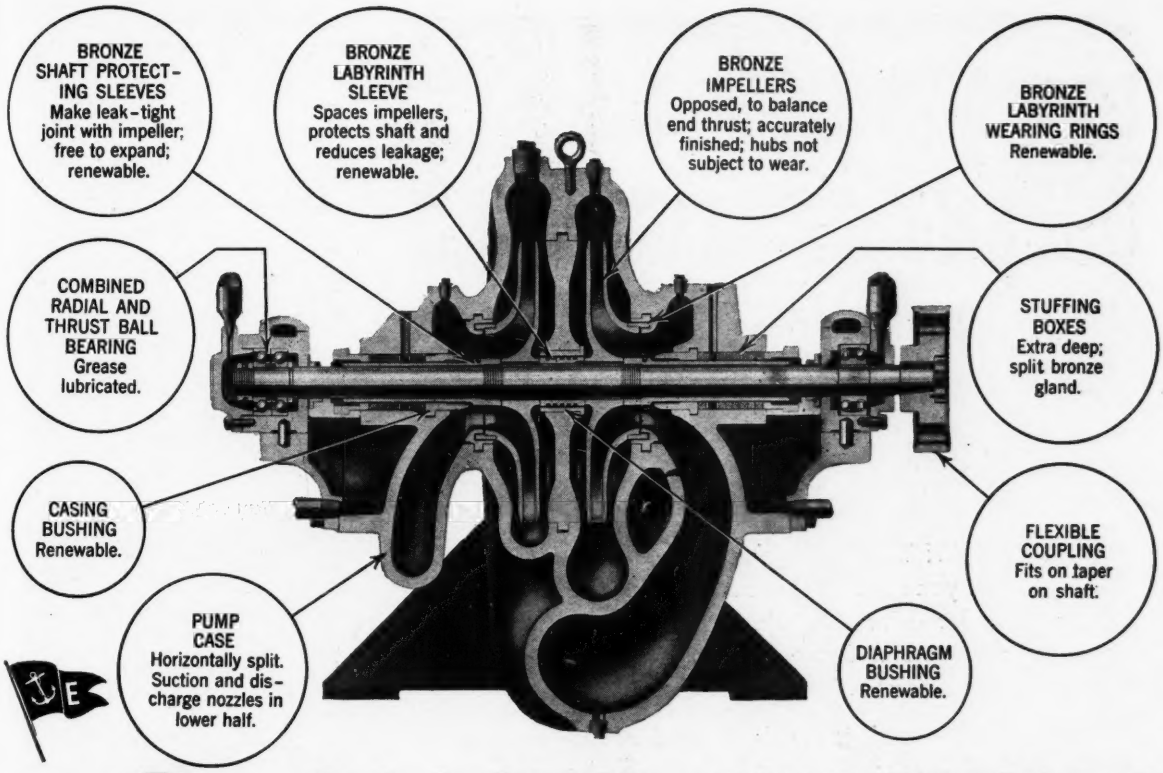
Square D Co., Detroit, Mich., announces the opening of two new branch offices to serve war material producers in strategic areas. C. T. Nash, formerly with the company's New York office has charge of the office at 146 Chestnut St., Springfield, Mass., and W. W. Hendrickson has been transferred from the Charlotte office to open an office in Greensboro, N. C., located at 303 Kensington Road.

Paul B. Huyette Co., Inc., 401 N. Broad St., Philadelphia, announced its appointment for three new accounts: the Ring Balance Instrument Co., Chicago, Ill.; Ellison Draft Gage Co., Chicago, Ill., and Permutit Co., Ranarex Div., New York.

Maintenance Program for Serving Industry

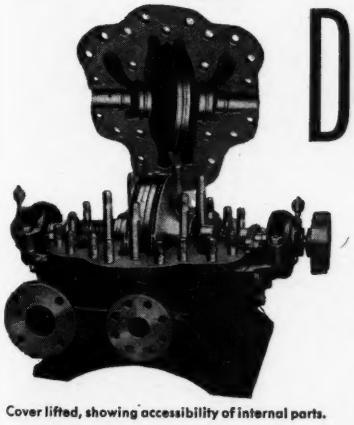
To KEEP PRESENT facilities in industrial and central station plants at peak production, a new maintenance program stressing fewer, shorter and longer-lasting repairs has recently been set up by the Westinghouse Elec. & Mfg. Co., according to H. R. Meyer, manager maintenance sales section. Highlights of the program are regularly scheduled customer contacts for the purpose of making necessary inspections, inventories, field service, and repairs. Maintenance sales engineers will be available to help determine renewal parts requirements and to assist in setting up an electric apparatus system whenever conditions warrant.

Anticipating the wartime need for a well-organized customer-maintenance program, a department known as maintenance sales was set up in December, 1941. It consists of a group in each district sales office to assist the salesman in making sure that renewal parts


BRONZE SHAFT PROTECTING SLEEVES Make leak-tight joint with impeller; free to expand; renewable.
BRONZE LABYRINTH SLEEVE Spaces impellers, protects shaft and reduces leakage; renewable.
BRONZE IMPELLERS Opposed, to balance end thrust; accurately finished; hubs not subject to wear.
BRONZE LABYRINTH WEARING RINGS Renewable.
COMBINED RADIAL AND THRUST BALL BEARING Grease lubricated.
STUFFING BOXES Extra deep; split bronze gland.
CASING BUSHING Renewable.
FLEXIBLE COUPLING Fits on taper on shaft.
PUMP CASE Horizontally split. Suction and discharge nozzles in lower half.
DIAPHRAGM BUSHING Renewable.

DE LAVAL OPPOSED IMPELLER PUMPS

for medium heads

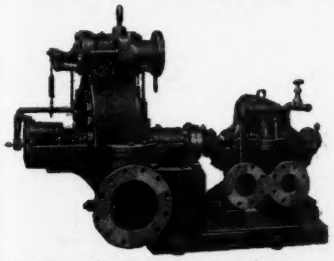


Cover lifted, showing accessibility of internal parts.

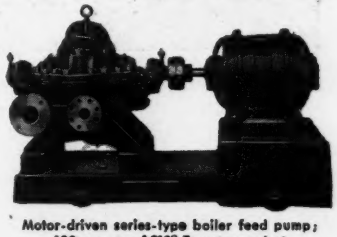
are suitable for services where two-stages are advantageous, including capacities up to 1500 g. p. m. and heads up to 800 ft.

The construction is simple, all internal parts being accessible upon lifting the casing cover. The rotor is in hydraulic balance. The short, stiff shaft permits of close radical clearances, resulting in reduced leakage and high efficiency. There are only two pairs of wearing rings, as in a single-stage pump. Points subject to wear are protected by wearing parts, renewable at small expense. All parts are made to limit gages upon an interchangeable basis.

Ask for Catalog B-3-3624



Turbine-driven opposed impeller boiler feed pump; 600 g. p. m. against 310 psi. at 3600 r. p. m.



Motor-driven series-type boiler feed pump; 100 g. p. m. of 210° F. water against 165 psi. at 3500 r. p. m.

HYDRAULIC INSTITUTE U.S.A. MEMBER

DE LAVAL *Steam Turbine Co.*

TRENTON, N. J.

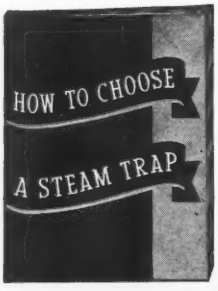
MANUFACTURERS OF TURBINES · STEAM, HYDRAULIC, PUMPS · CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, CLOGLESS, SELF-PRIMING · CENTRIFUGAL BLOWERS and COMPRESSORS · GEARS · WORM, HELICAL and FLEXIBLE COUPLINGS

Observe Fire Prevention Week, October 4-10

How to choose a STEAM TRAP

CAN YOU tell quickly what size steam trap you need on that autoclave, steam main, or header drip? Are you sure what style of trap should be used to get all the air instantly out of that steam kettle or steam chest?

These questions are simplified for holders of the book illustrated below. This free book tells what a steam trap must do . . . how it does its job . . . why air elimination is important . . . how to figure condensation rates . . . gives frequently used condensation rate tables . . . etc. Send for this useful book today—don't deny yourself its help. The book doesn't cost you a cent.



THE V. D. ANDERSON COMPANY
1939 WEST 96th STREET • CLEVELAND, OHIO

Super-Silvertop
STEAM TRAPS

More for Your Money

Because advertising is so widely used in the United States, we are the best informed people in the world on what there is to buy, what it will do for us and where to buy it. Because advertising is one of the most economical parts of the selling process and helps identify power plant products of known performance value, it is an important aid in getting more for your money.

are provided to take care of run-of-mine maintenance work, with emphasis on speedy action to get the machine back on the line should a breakdown occur. As part of the new organization, 34 Westinghouse repair plants located at strategic points throughout the country are completely equipped with the necessary facilities and personnel for rebuilding, repairing, and testing Westinghouse products.

Glass Company Makes Turbine Spindles

STEEL TURBINE spindle shafts for naval vessels are now in production at a plant of the Pittsburgh Plate Glass Co. under sub-contract from the Steam Division of the Westinghouse Elec. & Mfg. Co., according to L. E. Osborne, Westinghouse vice-president. The glass company's normal production of flat glass of various kinds calls for large-sized lathes, used to keep huge forming rollers in working condition. With the assistance of Joseph C. Bohan, manufacturing engineer of the Westinghouse company as a consultant, Pittsburgh Plate Glass was able to convert these lathes and retool them to operate at the extremely close tolerances needed for machining the intricately shaped turbine spindles. Tolerances as fine as 1/10,000th in. are common practice in the production of such marine propulsion equipment, which must be built to stand up under almost continuous operation over a wide speed range in the exacting job of driving the Navy's men-of-war.

NEWS FROM THE FIELD

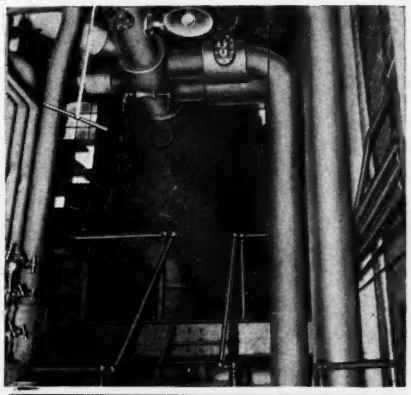
Robert M. Boyles, chairman of the Special Smoke Committee of the Joint Council of Associated Engineering Societies of St. Louis, was appointed City Smoke Commissioner, to succeed Raymond R. Tucker, as announced recently by Mayor William Dee Becker.

Power Show Transferred To Madison Square Garden

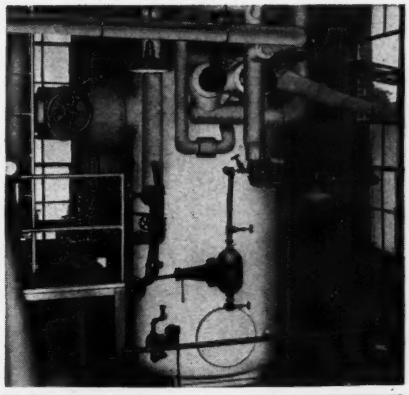
THE 15th Exposition of Power and Mechanical Engineering, which was scheduled to be held in Grand Central Palace, will be transferred to Madison Square Garden and will be held from Nov. 30 to Dec. 4.

The change is due to the fact that the U. S. Army has taken over the four exposition floors of the Palace to be used as an induction center for the duration. More than 150 exhibitors have taken space in the Power Show, and these will find ample room in Madison Square Garden. Space and arrangement of exhibits will be on a basis similar to the original plans. The exhibitors' list undoubtedly will be augmented considerably before the opening date.

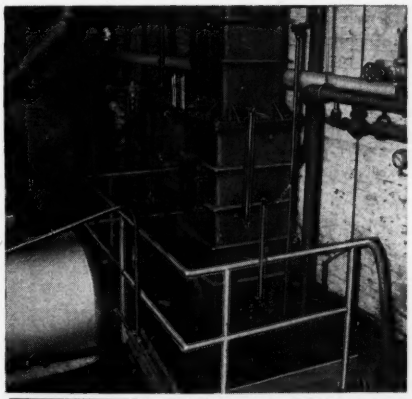
Charles F. Roth is manager of the exposition. Particulars regarding space may be obtained at headquarters, 480 Lexington Ave., New York, N. Y.



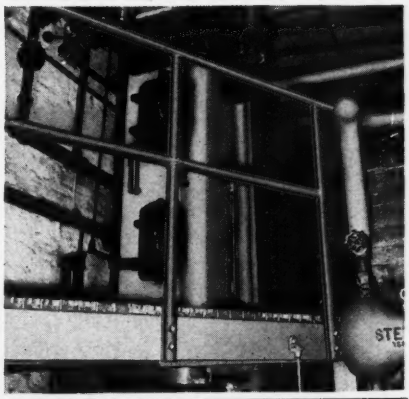
COCHRANE 300,000 LBS/HR DEAERATOR.



COCHRANE 120,000 LBS/HR DEAERATOR.



COCHRANE 20,000 LBS/HR DEAERATOR.



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ONE OF THE LARGEST TEXTILE MILLS IN THE SOUTH

has installed Cochrane Deaerators in all of its plants in capacities ranging from 9,000 lbs/hr to 300,000 lbs/hr. The removal of oxygen and other dissolved gases and the complete heating of the boiler feedwater have aided considerably in the efficient operation of the boiler plants in these famous mills.

Power Plants from the smallest industrial to the largest central station are equipped with Cochrane Deaerators designed for their specific needs.

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NATIONAL FIRE PREVENTION WEEK-OCT. 4-10

WAR PRODUCTION PLANTS

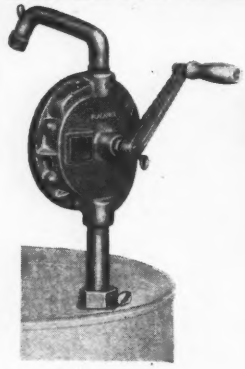
are Using

BLACKMER
• ROTARY •
HAND PUMPS

for Handling

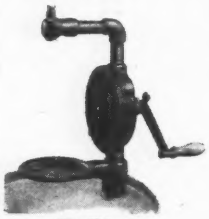
HAZARDOUS LIQUIDS—

paints, lacquers, benzol, solvents, thinners, alcohols, gasoline, naphtha—from stockroom barrels, tanks or vats.



AT 404
Barrel unit

AT 609
Heavy duty
barrel unit



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You may choose from 54 STANDARD MODELS of Blackmer Hand Pumps. "The right pump for every purpose." Capacities from 5 to 25 GPM. Complete tank or barrel units or pumps only.

Prompt shipment on proper priority ratings.

Bulletin 205—"Rotary Hand Pumps" is yours for the asking.
Write Blackmer Pump Company,
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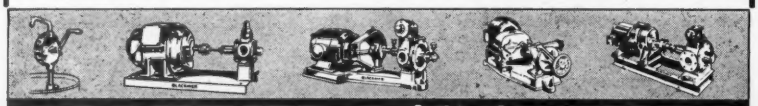
Grand Rapids, Michigan.



BLACKMER Rotary PUMPS

"BUCKET DESIGN"—SELF-ADJUSTING FOR WEAR

Looking Ahead . . .

In the power field, perhaps more than in other basic industrial fields, the continuous betterments in machinery and methods compel men to look ahead with broader vision and greater determination than ever before.

Reading the advertising messages that appear in POWER PLANT ENGINEERING will keep you informed on new trends and opportunities. Month after month, these advertisements describe what's new in generating, transmitting power. They will help you and your plant join the onward march of the power plant industry.

New Dates for Safety Congress

THE DATE and location of the 31st National Safety Congress and Exposition have been changed due to the fact that the government has taken over for military purposes the Stevens and Congress Hotels in Chicago, where the Congress originally was to have been held.

The 1942 Congress will be held October 27, 28, 29. It will be housed in three big Chicago hotels—the Sherman, the La Salle and the Morrison. Convention headquarters will be in the Sherman.

These changes will in no way affect the size, scope and importance of the Congress. There will be 200 sessions, with 500 program participants.

Chemical Show to Aid Salvage Campaign

WITH the Industrial Salvage Section, Conservation Division of the WPB participating, the National Chemical Exposition set for November 24 to 29 at the Sherman Hotel in Chicago will emphasize the war effort.

Arrangements have been made for an educational exhibit which will stress the campaign to salvage approximately 100,000 lb. of essential chemicals.

This program provides for the reclamation of millions of gallons of war-essential chemical solvents, paints of all kinds, oils and chemical by-products. Exhibit space has been assigned to more than 100 firms in the chemical and allied industries including manufacturers of equipment, precision instruments, materials and products.

A feature exhibit will be a gallery of micrographs contributed by 40 laboratories which are using the electronic microscope.

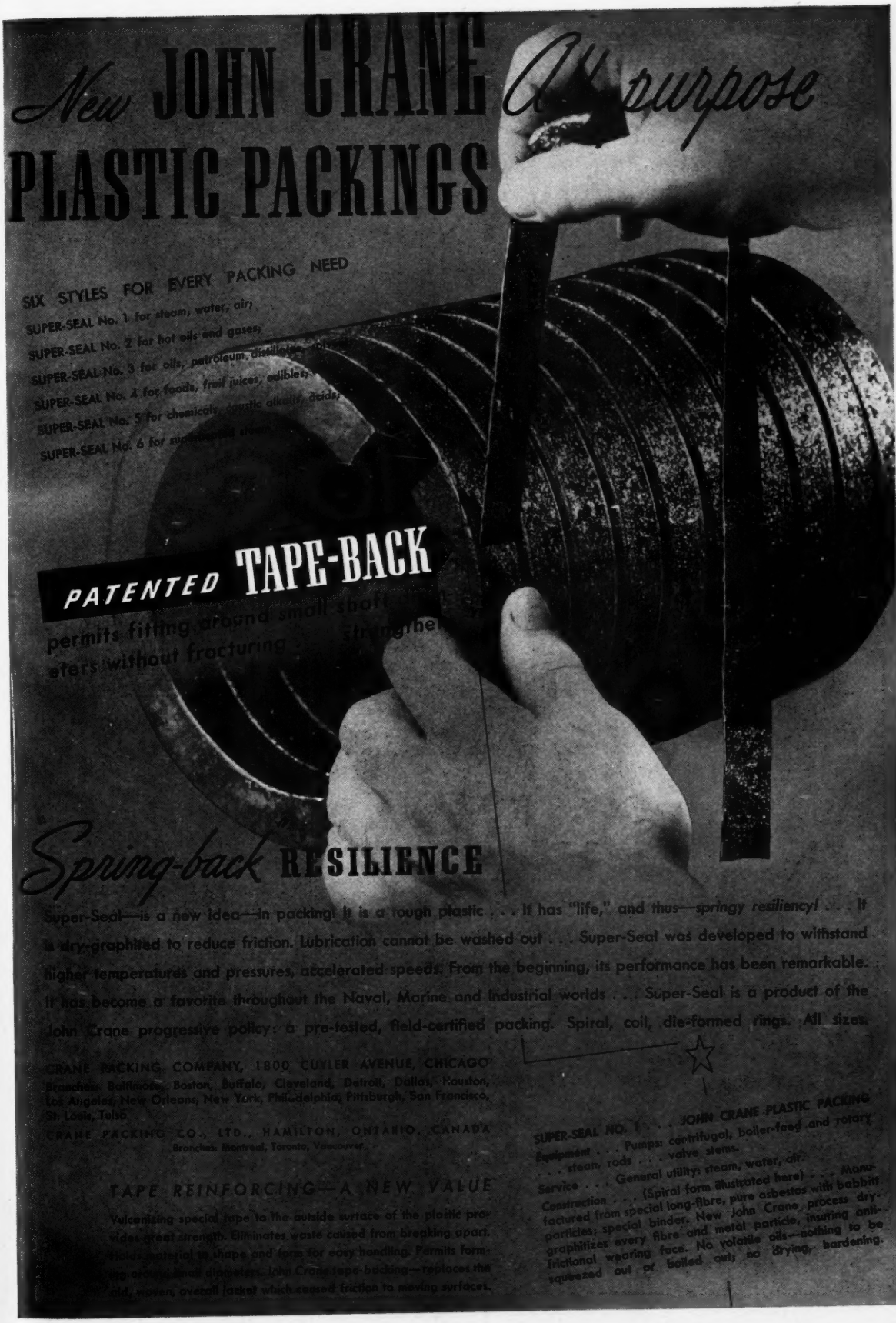
Another contribution designed to be of aid to the war effort will be a special exhibit of "alternates and substitutes," now being assembled by Dr. Harrison E. Howe.

Compressed Air Institute Awards

DESCRIBING the successful application of compressed air to increase the speed of producing cartridge cases by about 500 per cent, A. W. Lancaster of Orillia, Ontario, received first prize of $200 today in the Compressed Air in Industry contest.

The award was made by the Compressed Air Institute of New York, which conducted the contest to increase the widespread interest and application of compressed air in industry, transportation and many other activities.

There were three second prizes of $100 each going to Irving G. Mayer of Phoenix, Arizona, a chemist at the Arizona Refining Co. who showed how compressed air may be used in rapidly laying a mat of asphalt on roads and other structures; Lt. Albert J. Nauta of the Army Air Base, Daniel Field, Augusta, Ga., for showing a method of freeing water of iron by passing through it a strong current of compressed air; Harold W. Martin of the Allis-Chalmers Mfg. Co., Boston, Mass., for demonstrating the use of compressed air blasts for breaking circuits in high voltage lines. Also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PLASTIC PACKINGS
SIX STYLES FOR EVERY PACKING NEED
SUPER-SEAL No. 1 for steam, water, air;
SUPER-SEAL No. 2 for hot oils and gases;
SUPER-SEAL No. 3 for oils, petroleum, distillates, oil
SUPER-SEAL No. 4 for foods, fruit juices, edibles;
SUPER-SEAL No. 5 for chemicals, caustic alkalis, acids;
SUPER-SEAL No. 6 for
PATENTED TAPE-BACK
permits fitting around small shaft
eters without fracturing
strengthe
Spring-back RESILIENCE
Super-Seal—is a new idea—in packing! It is a tough plastic . . . It has "life," and thus—springy resiliency! . . . It is dry-graphited to reduce friction. Lubrication cannot be washed out . . . Super-Seal was developed to withstand higher temperatures and pressures, accelerated speeds. From the beginning, its performance has been remarkable. It has become a favorite throughout the Naval, Marine and Industrial worlds . . . Super-Seal is a product of the John Crane progressive policy: a pre-tested, field-certified packing. Spiral, coil, die-formed rings. All sizes.
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Branches: Baltimore, Boston, Buffalo, Cleveland, Detroit, Dallas, Houston, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Tulsa
CRANE PACKING CO., LTD., HAMILTON, ONTARIO, CANADA
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TAPE REINFORCING—A NEW VALUE
Vulcanizing special tape to the outside surface of the plastic pro- vides great strength. Eliminates waste caused from breaking apart. shields material to shape and form for easy handling. Permits form- ing of rings of small diameters. John Crane tape-backing—replaces the old, woven, overall jacket which caused friction to moving surfaces.
SUPER-SEAL NO. 1 . . . JOHN CRANE PLASTIC PACKING
Equipment . . . Pumps: centrifugal, boiler-feed and rotary . . . steam, rods . . . valve stems.
Service . . . General utility: steam, water, air.
Construction . . . (Spiral form illustrated here) . . . Manu- factured from special long-fibre, pure asbestos with babbitt particles; special binder. New John Crane process dry- graphitizes every fibre and metal particle, insuring anti- frictional wearing face. No volatile oils—nothing to be squeezed out or boiled out; no drying, hardening.

Are Your Tube Cleaners Ready for Action?

If your plant is equipped with Roto Tube Cleaners, you can help to continue their good work for a longer time by keeping them in perfect running order. Why wait until they wear out beyond repair, when an inexpensive adjustment or parts replacement can bring them back to first class condition, if done in time?

Now, while you think of it, examine your motors, check your stock of cutter heads, operating hose and couplings. Let our specially trained mechanics make any necessary adjustments or repairs. By giving us a little time we can serve you much better.

Don't put it off. See that your Roto Tube Cleaners are ready for the Battle of Production, now.

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When writing advertisers for catalogs, descriptive bulletins or prices, please remember to say, "I saw your message in POWER PLANT ENGINEERING." Thus you'll do a good turn for the advertiser and for this publication. . . . . .

awarded were ten prizes of $50 each to Joseph M. Weil of Easton, Pa., Paul Hoffman of Phillipsburg, N. J., Vincent L. Greth of Lakewood, O., George C. Tucker of Barre, Vt., Frank D. Biesanz of Winona, Minn., Joseph P. Burdett of Whittier, Cal., S. F. Shaw of San Antonio, Tex., Stephen M. Dunham of West Orange, N. J., Rex T. Stafford of Pittsburgh, Pa., and P. O. Egner of Houston, Tex.

Compressed Air Institute Meeting

THE Compressed Air Institute held a 2-day meeting at Hotel Hershey, Hershey, Pa., Sept. 10 and 11 for interchange of ideas in an effort to further streamline and speed up the output of vitally-needed compressed air equipment. Chairman of all sessions was Joseph deV. Keefe, president, The Dallett Co., Philadelphia, who is president of the Institute. He was assisted by C. C. Rohrback, Secretary.

Member companies, all of whose products are important as direct war equipment or as war-production machinery, include: Allis-Chalmers Mfg. Co., The Buckeye Portable Tool Co., Bury Compressor Co., Chicago Pneumatic Tool Co., Clark Brothers Co., Inc., The Cleveland Pneumatic Tool Co., The Cleveland Rock Drill Co., The Dallett Co., De Laval Steam Turbine Co., Elliott Co., Fuller Co., Gardner-Denver Co., Independent Pneumatic Tool Co., Ingersoll-Rand Co., William H. Keller, Inc., Nash Engineering Co., Nordberg Mfg. Co., Pennsylvania Pump and Compressor Co., Roots-Connersville Blower Corp., The Rotor Tool Co., Schramm, Inc., Sullivan Machinery Co., Worthington Pump and Machinery Corp.

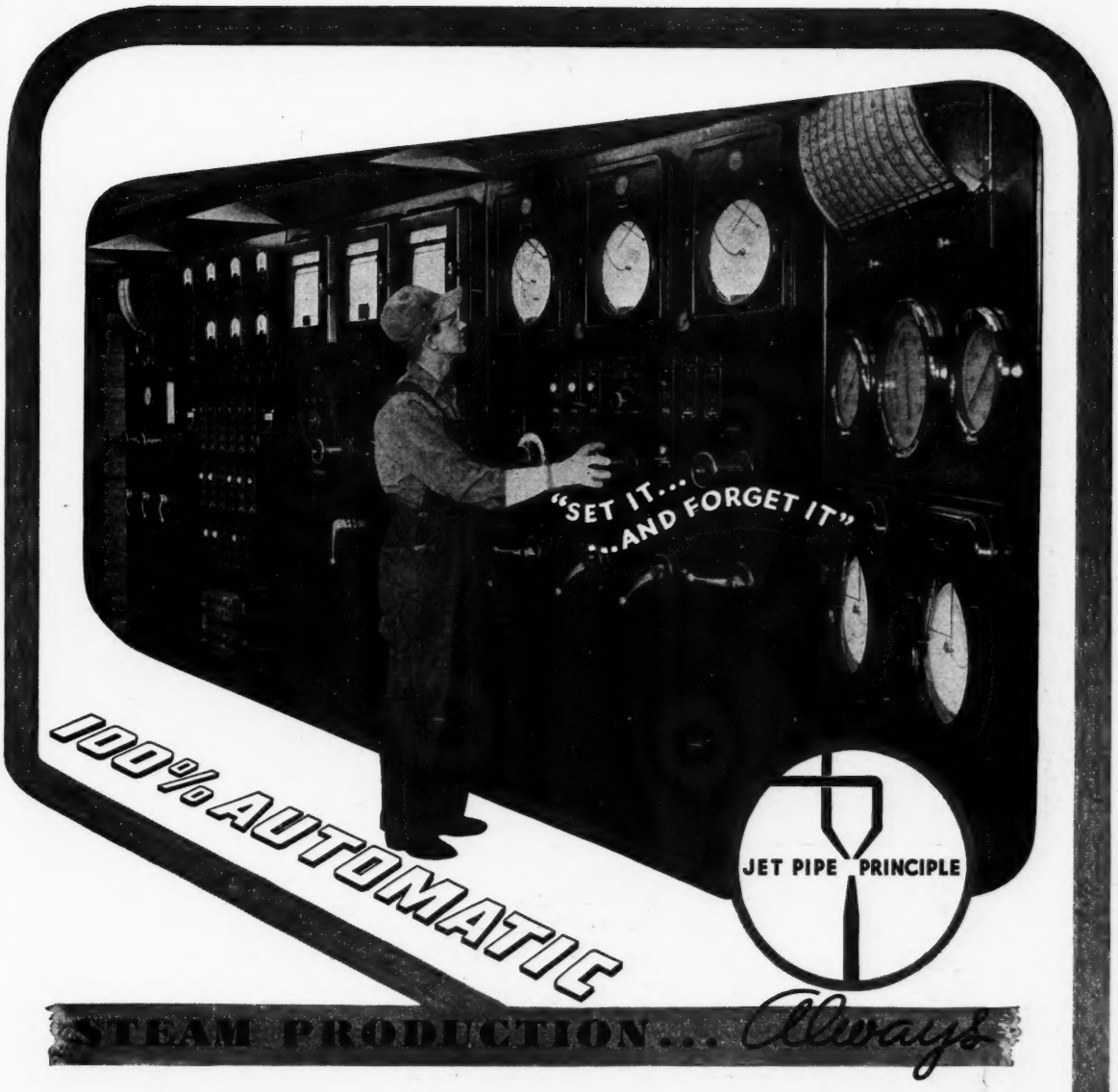
Cornell U. Building to Be Dedicated

OLIN HALL of Chemical Engineering, new home of the School of Chemical Engineering at Cornell University, will be officially dedicated on October 3, President Edmund E. Day has announced. Because of the war, exercises will be brief and informal, but a group of distinguished industrial and educational leaders will be in Ithaca for the occasion.

Speakers at the ceremony will include Franklin W. Olin, president of the Western Cartridge Co., who gave the funds for the building; John L. Collyer, president of the B. F. Goodrich Rubber Co.; President Day; and Dr. Fred H. Rhodes, Henry Fisk Johnson, Professor of Industrial Chemistry and Director of the School of Chemical Engineering. Dr. S. C. Hollister, Dean of the College of Engineering, will preside.

During the ceremony, a plaque will be unveiled dedicating the structure to the memory of Franklin W. Olin, Jr., who was graduated from Cornell in 1912 and died in 1921.

The new building is designed to accommodate 450 undergraduates, as well as a proportionate number of graduate students in chemical engineering. It includes a 3-story unit operations laboratory, especially built to carry out the educational program developed at Cornell by Dr. Rhodes. Olin Hall is the first building in a



Out in Cedar Rapids, Iowa, Askania went to work for the Iowa Electric Light and Power Company in 1937. The job was to provide 100% Automatic Control on the first two units of 300,000 lbs. steam capacity. This included complete control of hydraulic couplings. Since then two similar units have been added... also Askania equipped.

Now plans call for the installation of units five, six, seven and eight ...and these also will be Askania equipped! Isn't the answer obvious?

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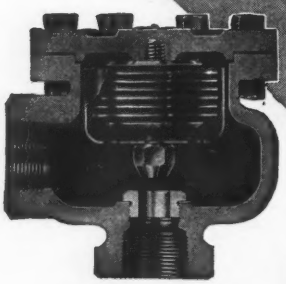
A bulletin describing the advantages of Askania's Jet Pipe Principle as applied to Automatic Control of Steam Generating Units is available. Address, Askania Regulator Co., 1601 S. Michigan Ave., Chicago.

ASKANIA
REGULATOR CO. CHICAGO
AUTOMATIC CONTROL

Avoid FREEZE-UPS
Install
NICHOLSON
Industrial Steam Traps



HERE is a trap that completely drains itself. It is non-freezing and non-airbinding, requires no adjustment. Ideal for outside installations or in buildings where steam is off at times during the winter.

Nicholson Traps are available in Bronze, Cast Iron and Cast Steel construction in sizes ¼ to 2 in. Good for pressures up to 300 lb. Specify Nicholsons for improved drainage of Unit Heaters, Pipe Coils, Water Heaters, etc. Write for new Steam Trap Catalog No. 941.

Also NICHOLSON—
Welded Floats,
Piston and Weight
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Flexible Couplings,
Steam Eliminators
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Compressed Air
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COMPLETE INFORMATION
ON SUBSTITUTES FOR TIN-BASE BABBITTS

New bulletin
SHOWS WHAT BEARING METAL TO USE WHERE

Write for your copy of this Magnolia manual which tells how to effectively substitute lead-base babbitts for tin-base bearing metals. This booklet answers your war-created bearing problems. Write today!

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18 West Jersey Street, Elizabeth, N. J.

MAGNOLIA BEARING METALS

proposed new physical plant for the College of Engineering. Plans for four additional buildings have been prepared, and construction is expected to be resumed after the war.

Sullivan, Technical Director of I.G.T.

DR. FREDERICK W. SULLIVAN, JR., has been appointed technical director of the Institute of Gas Technology, Chicago, Ill., as announced by Director Harold Vagtborg. Recently manager of chemical research at the Barrett Division of Allied Chemical & Dye Corp., Dr. Sullivan was also director of research for Standard Oil Co. of Indiana. He had joined this organization as assistant director of research in 1923 and left as director in 1938. He received his B.S., Master of Science and Ph.D. degrees in 1918, 1919 and 1921, respectively, from the University of Michigan. Dr. Sullivan as technical director will have direct supervision of all research work at the Institute, both on specific projects for individual firms and on general projects which the Institute carries on for the entire gas industry. The new technical director is among the leading scientists in his field in the nation today. He has been active in the American Petroleum Institute and is councilor for the American Chemical Society. In 1933 he was chairman of the petroleum division of that organization and in 1934 was president of the Chicago Chemists' Club.

War Manpower Commission Conference

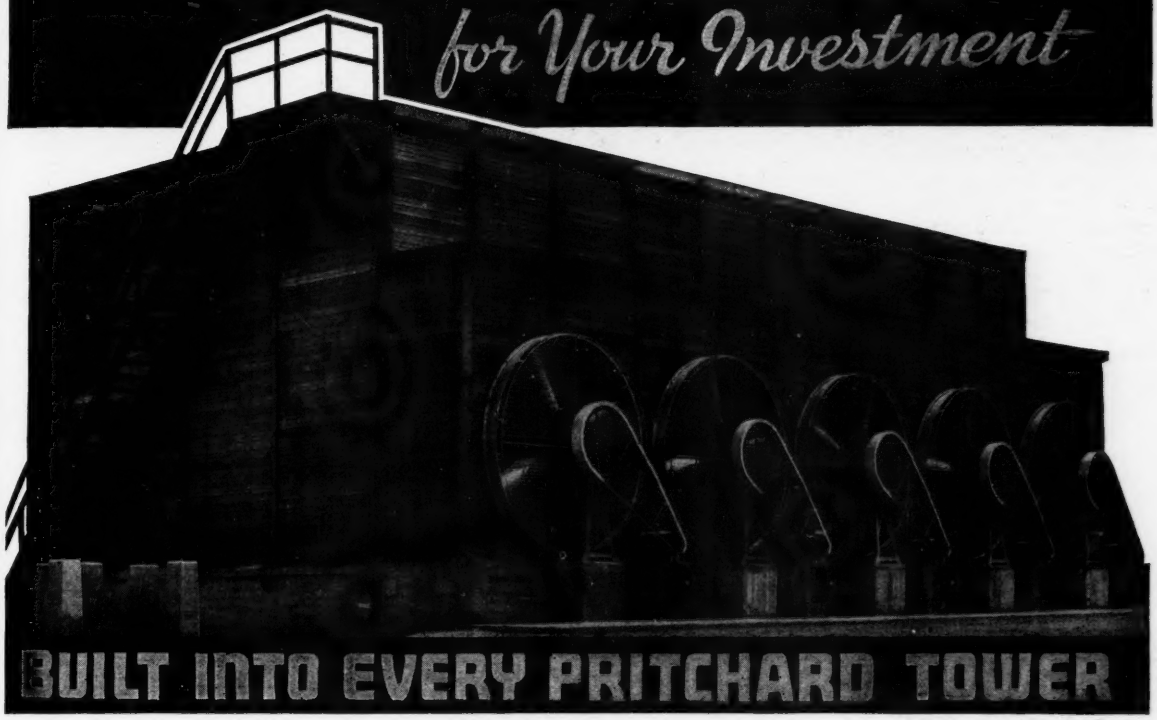
THE War Manpower Commission met with industrial managers at a conference of the American Management Association on September 29-30 in New York City and outlined a program the Commission developed to meet the manpower problem.

Companies from virtually every industry in the United States were represented at the sessions which featured addresses by members of the War Manpower Commission and discussions of specific labor supply questions. The Conference was planned under the direction of L. A. Appley, vice-president of Vick Chemical Co. and vice-president in charge of AMA's Personnel Division.

The speakers of the conference, which was held at the Hotel Pennsylvania included: Fowler V. Harper, Deputy Chairman, War Manpower Commission; Major General Lewis B. Hershey, Director, Selective Service System; Brigadier General Frank J. McSherry, Director of Operation, War Manpower Commission; Arthur Flemming, Commissioner, United States Civil Service Commission; and John Corson, Director, United States Employment Service.

Hundreds of questions which the Association has received from companies throughout the country formed the basis of discussion at the sessions. The questions relate to such subjects as worker supply, labor allocations, transfers of workers, and military deferment of key workers, the role of the United States Employment Service as a central hiring agency, union problems in the transfer of workers, the drafting of young technical students, and operations of regional manpower commissions.

THREE PROTECTIONS *for Your Investment*



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PRITCHARD ATMOSPHERIC TOWERS have all the rugged construction, liberal safety factors and low pressure water distribution of mechanical draft types. They are designed with or without auxiliary cooling coils and are featured by deck level air flow and retriever type drift control.

1. Rugged Construction, like the tower above, made of heart redwood with heavily reinforced bolted frame, tongued and grooved double sheathing.

2. "Featherweight" Monel Fans that don't pit or corrode . . weigh half as much as ordinary fans . . move more air per horsepower . . reduce driving equipment wear.

3. Full Rated Capacity and other liberal safety factors that mean efficient, economical operation under continued peak loads when many towers fail.

Some of the largest orders ever placed for water cooling equipment have been for Pritchard cooling towers.

J. F. PRITCHARD & COMPANY
FIDELITY BUILDING, KANSAS CITY, MISSOURI
BRANCH OFFICES IN TULSA, OKLA.; HOUSTON, TEXAS; ATLANTA, GA.
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PRITCHARD
Atmospheric and Mechanical Draft
WATER COOLING TOWERS

AN IMPORTANT SERVICE IN THE NATIONAL WAR EFFORT

WE RID YOU OF THIS HAVOC QUARTET
CORROSION
1
Works havoc in your pipes, boilers and heat exchangers
BACTERIAL DEPOSIT
2
Makes itself at home and plugs up your pipes and tubes
HOT WATER SCALE
3
Fights hard to keep you from getting water necessary for production
OILY BOILER DEPOSIT
4
Eats up power and bags your tubes

We conserve metals difficult to replace. We have solved the condensate corrosion problem in steam systems. In the Cook County Nurses' Home in Chicago, where extra heavy wrought iron piping withstood corrosive condensate only thirty days, Haering Glucosates corrected the condition, and test pieces six months later were free from corrosion deposits. We protect metals in boilers, piping, condensers and heat exchangers, too.

The Glucosates also conserve energy. Less fuel is needed—more production obtained—where Glucosates control scale, corrosion and living organisms. The Glucosates save raw materials too. Less chemicals are used where Glucosates substitute for common inorganic materials.

Write today for free booklets of complete story. We will send sample containers and data forms to enable you to give us an accurate picture of your water problems.

Visit the "Chamber of Scale and Corrosion Horrors" in our booth No. 50 at the National Chemical Exposition, Hotel Sherman, Chicago, Nov. 24-29.

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WE READ WATER

Save Time—Look First In The "Where-To-Buy" Directory

Suppose you need gaskets, gauge glasses, pump governors, steam traps or other power service equipment in a hurry.

Do as hundreds of engineers and plant executives do—turn first to the handy "Where-To-Buy" Directory published in this issue.

You'll find there comprehensive up-to-date product listings of well-known concerns which advertise regularly in POWER PLANT ENGINEERING. They probably have branches or sales agents in your locality.

Other sessions of the Conference were devoted to War Labor Relations problems; Wage Stabilization, Keeping Manpower at Work, and Dealing with the War Labor Board.

July Use of Electric Energy A New High

ELECTRIC energy produced for public use in July, 1942, broke all records by totaling 15,762,924,000 kw-hr., an increase of 11.9 per cent over production in July, 1941, according to a report issued by the Federal Power Commission.

Average daily production of electric energy for public use in July was 541,681,000 kw-hr., a new high and an increase of 1.9 per cent from average daily production during the previous month. Production of water power in July amounted to 5,107,551,000 kw-hr., or 32.4 per cent of the total output for public use.

For the 12 mo. ended July 31, 1942, total production for public use was 176,830,491,000 kw-hr., an increase of 14.4 per cent over the 154,514,822,000 kw-hr. produced in the 12 mo. ended July 31, 1941.

The capacity of generating plants in service in the United States on July 31, 1942, totaled 45,620,864 kw., a net increase of 284,071 kw. over generating capacity reported in service on June 30, 1942. However, occasionally changes are made in plants which are not reported promptly, so that capacity figures shown for any one month do not necessarily mean that all the changes were made during that month but that they have been reported to the Commission since the issuance of the previous monthly report.

Use Increases Coal for Electric Energy

ELECTRIC utility power plants consumed 5,972,800 t. of coal in the month of July. This figure was released in the Federal Power Commission's publication, and the same source also stated that the coal stocks of utility companies were the highest in history, being 60.9 per cent over the same date last year.

Of the total consumed, 5,713,206 t. were bituminous coal, an increase of 10.4 per cent over June consumption, and 259,594 t. were anthracite, an increase of 12.8 per cent for the same month.

Fuel oil consumed during this same period totaled 1,208,229 bbl. against 923,391 bbl., or an increase of 30.8 per cent.

Gas consumed in July increased 7.5 per cent over the consumption in June, or 23,016,399 MCF compared to 21,406,490 MCF.

Production of Synthetic Rubber Conveyor Belt

THE Hewitt Rubber Corp., Buffalo, N. Y., has now completed the manufacture of an all-synthetic rubber conveyor belt which is believed to be the first of its kind made from Buna S synthetic rubber, without the addition of natural rubber or reclaimed rubber.

Buna S is made by a chemical combination of butadiene and styrene, and is the general purpose rubber for which our Government is building plants to produce 700,000 t. per yr.

Expert installation assures longer life from your super refractories

THE maximum service from your super refractories can be obtained only by proper installation.

Since there are no rule-of-thumb methods that can be followed in all cases with any reasonable degree of satisfaction, each installation must be considered separately on its own unique requirements. Each boiler furnace, heat treating unit, gas generator, roaster or retort furnace, for example, presents different problems requiring individual solutions to assure greatest longevity and reliability of service from the refractories.

And right here our refractories engineers can assist you. They have had years of experience with the application of super refractories to practically every kind of furnace and kiln. With this background they know what installation methods will result in the longest service from these materials in your equipment.

The benefit of their experience is yours for the asking. A letter will receive our immediate attention.

CARBORUNDUM

Refractory Division

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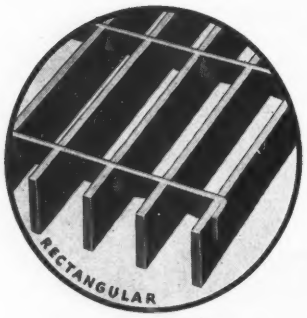
(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)



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SAFETY STEPS
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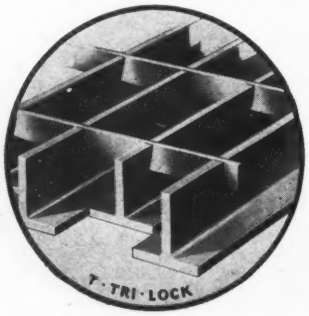
REPRESENTATIVES IN PRINCIPAL CITIES



Southwestern Gas Plans Generating Station

THE Southwestern Gas & Electric Co., Shreveport, La., has plans under way for new steam-electric generating station in the Caddo Lake district, where site has been selected. Installation will include turbine-generator units and accessories with initial capacity of 30,000-kw., high pressure boilers and auxiliary equipment. New plant will be known as the Albert Lieberman Station, named in honor of late president of company. It is estimated to cost close to $3,000,000, with transmission lines. Station will form a unit of the Southwest Power Pool, comprising several central stations in the Southwestern area. The company has work nearing completion on a new power substation and switching station at Ashdown, Ark., costing about $250,000, to be used in connection with new generating station and power pool.

Auto Mechanics Wanted for Military Duty

A DRIVE to recruit not less than 22,000 experienced automobile mechanics for overseas military duty before the end of 1942 has been launched under the sponsorship of the National Automobile Dealers Association. Already two regiments of 8000 men have been recruited and installed at Camp Sutton, S. C., and the expectations are that before next year Uncle Sam will have a force of at least 30,000 mechanical experts to help keep his motorized fighting equipment in condition for active service. Enlistment under NADA sponsorship is entirely voluntary. The type of men sought are automobile dealers, mechanics, salesmen and others who are familiar with automobile maintenance, as this is the type of work they will do in the Army. It offers a man in the draft, or those who have been thrown out of employment by the curtailment of automobile production, a chance to continue their specialized work as soldiers. The units are made up entirely of mechanical specialists.

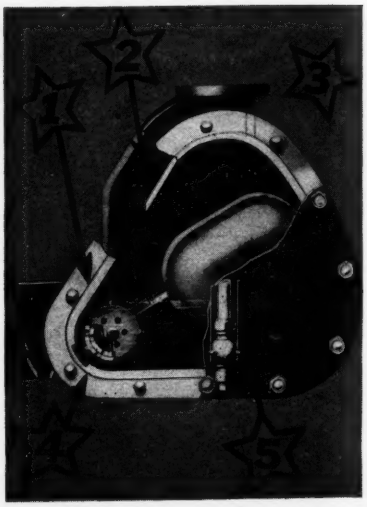
More Generators for Grand Coulee

WORK has been started on three additional 108,000 kw. waterwheel generators for Grand Coulee Dam to power aluminum plants and other war industries in the Pacific Northwest. This brings to nine generators, the largest in the world, which Westinghouse has contracted to build for Grand Coulee. Three of the machines have already been built and installed at the huge hydroelectric power development in the state of Washington and three have been under construction since August, 1941.

Each generator is 24 ft. high and 45 ft. in diameter and consists of 1000 tons of parts and requires 38 freight cars for shipment to the dam. The heaviest parts are the steel frame; the spider, a single piece of steel weighing 75 tons used to support the rotating mechanism on the shaft; and a 74 ft. steel shaft, weighing 153 t., which is so long that it has to be made in three parts and bolted together.

Ultimately, Grand Coulee will have 18 of these giant generators, making it the largest single source of power in the world. After the war some of

5 reasons why
COCHRANE MULTIPORT DRAINER
Is the IDEAL DRAINER



1. ONLY ONE MOVING ELEMENT, with rotating valve directly attached to float stem, all self contained within an integral housing.
2. TREMENDOUS DISCHARGE CAPACITY is assured by unusually large port areas. Condensate is discharged through a rotating cylindrical valve, as through an orifice, except that there are 6 such orifices in the valve.
3. POSITION HANDLE on outside of body permits closing valve or opening it wide: full opening thus secured serves as an effective blow off.
4. COMPLETE ACCESSIBILITY of valve is provided by removable cover plate, without necessity of disturbing mechanism or piping connections.
5. GAGE-GLASS, with guards and try cock, shows visibly the height of condensate at all times.

Write for a copy of Publication 2925.

COCHRANE CORP., 3123 N. 17th St., Philadelphia, Pa.

Cochrane

HOW TO GET A NEW PLANT IN OPERATION OR AN OLD ONE BACK INTO SERVICE *in a Hurry!*

Use Republic ELECTRUNITE Boiler Tubes!

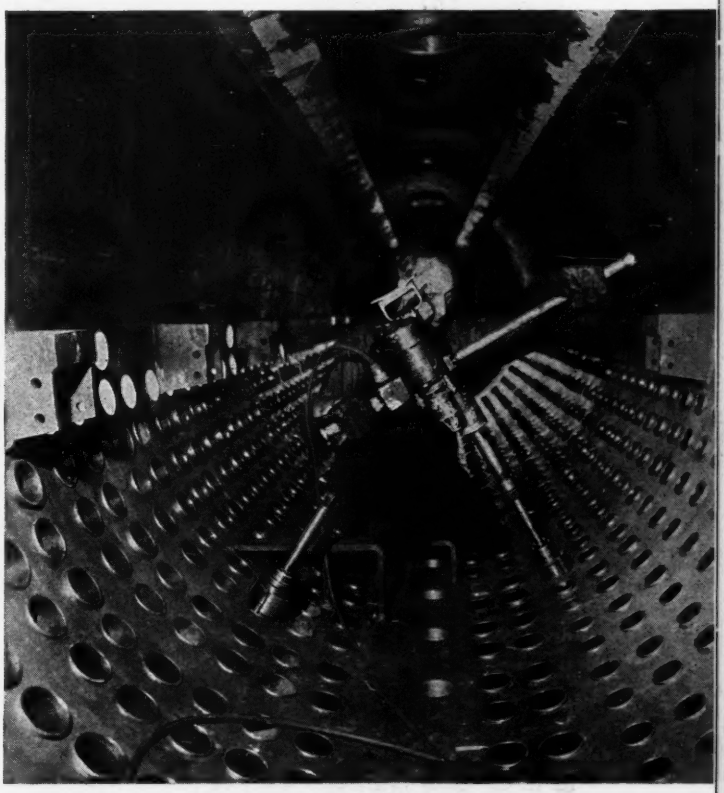
The inherent advantages of these electric resistance welded tubes shift tubing and re-tubing jobs into high gear—cut "down-time"—permit boilers to go into operation sooner.

ELECTRUNITE Tubes have a consistent uniformity of diameter, wall thickness, roundness and ductility not found in tubes made by other processes—because they're made from flat-rolled steel and electric resistance welded.

To the man who wants real speed in tubing installation, these qualities mean free and easy sliding of tubes through holes in tube sheets or drums—fast, sure roller expanding to tight, non-leaking joints—clean, smooth beading over—sound, strong welds. An idea of the speed obtained can be obtained from reports of savings in installation by users—up to 30%.

And once installed, ELECTRUNITE Tubes will render long trouble-free service. Their high strength is proved by hydrostatic testing within 20% of the minimum yield point of the steel. Their smooth, scale-free surface does not invite corrosion.

Write us for further details—and if you expect the need of tubes in the near future, give us or your nearest ELECTRUNITE Distributor full information on your requirements at the earliest possible date. You'll save time when time will count most.



STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
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ELECTRIC RESISTANCE WELDED BOILER, CONDENSER AND HEAT EXCHANGER TUBES

SIMPLEX

STEAM • COLD WATER • BOILER FEED

POWER

• CONDENSATE • EVAPORATE •

PLANT

• AIR • GASES • CORROSIVE LIQUIDS •

METERS

Type MS Meters for service as a flow indicator, recorder, indicator and recorder, indicator and totalizor, recorder and totalizor, or indicator, recorder and totalizor.

SIMPLEX VALVE & METER COMPANY
6783 UPLAND STREET, PHILADELPHIA, PA.

the electricity will be used eventually to pump water into the vast, semi-arid Big Bend area, 50 to 125 mi. southwest of the dam. There, the water will restore productivity to about 1,200,000 a. deprived by the Cascade Mountains of moisture bearing winds from the Pacific Ocean.

Obituaries

W. A. Stubblebine

W. A. STUBBLEBINE, a pioneer in the field of pulverized-coal firing, died on August 27. Born in Bethlehem, Pa., where he graduated from Lehigh University, he began his career with Bethlehem Steel Co. in 1895 and for the next 14 yr. was engaged in drafting, engineering, and construction work for steel companies. In 1909 he went with the Fuller Lehigh Co., Fullerton, Pa., where he was active in the development of pulverized-coal firing and furnace construction. In 1923 he transferred to the Trumbull Steel Co., Warren, O., where he had charge of one of the pioneer pulverized-coal-fired boiler plants. In 1927 he returned to the Fuller Lehigh Co. which had been acquired by The Babcock & Wilcox Co. and for 3 yr. he was representative abroad, with headquarters in London, England. He was active in the design and operation of pulverized-fuel installations since 1931, when the operations of the Fuller Lehigh Co. and The Babcock & Wilcox Co. were consolidated. He was a member of the A. S. M. E.

Edward W. P. Smith

EDWARD W. P. SMITH, 56-yr. old consulting engineer for The Lincoln Electric Co., Cleveland, Ohio, died aboard a train enroute from Indianapolis to Cleveland, September 19. Before joining Lincoln Electric Co. more than 20 yr. ago, Mr. Smith had worked in the electrical inspection department of the city of Cleveland and for the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. He was a graduate of Colorado College.

A frequent contributor of technical articles to the trade and technical press, Mr. Smith was a member of the American Welding Society, A. S. M. E. A. S. T. M. and the Cleveland Engineering Society.

Harry T. Thompson

HARRY T. THOMPSON, district manager of the Metal & Thermit Corp., died at his home in Mt. Lebanon, Pa., on August 19, at the age of 53.

Born in Chattanooga, Tenn., Mr. Thompson attended the McCallie School of Chattanooga and was graduated from Georgia Institute of Technology in 1912. During World War I he served in France as a captain in the Field Artillery. After returning to civilian life, he became associated with the Differential Steel Car Co., Findlay, O., and was later made a vice-president and director of the company, an association which continued until his death. In 1931 he joined the sales organization of the Metal & Thermit Corp. Shortly thereafter, he was appointed district manager and placed in charge of the corporation's Pittsburgh branch, which serves the Central Atlantic and Southeastern states. He was a member of the American Welding Society.

SAUERMAN

Power Scrapers

★ **The problem of storing coal safely and economically has been solved permanently at hundreds of steam generating plants, both large and small, by installing Sauerman Power Scrapers.**

A Sauerman scraper unit has no equal for simplicity of installation and operation, nor does any other method of storing and reclaiming carry as positive an assurance of building a coal-pile that will be free from the chance of spontaneous combustion.

Write for Catalog.

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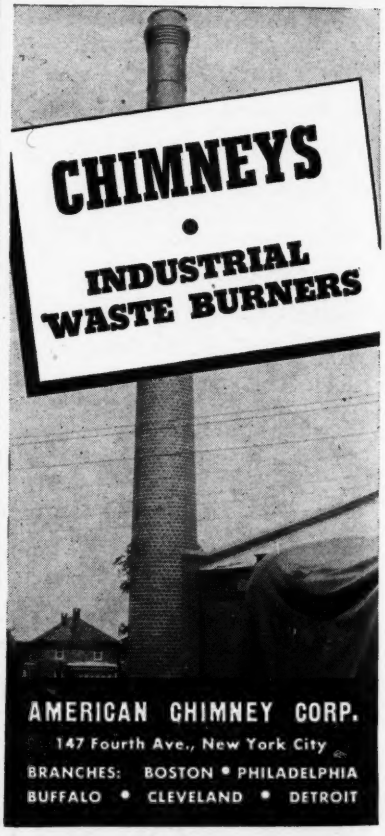
586 S. Clinton St., CHICAGO



AMERICAN CHIMNEY CORP.
147 Fourth Ave., New York City
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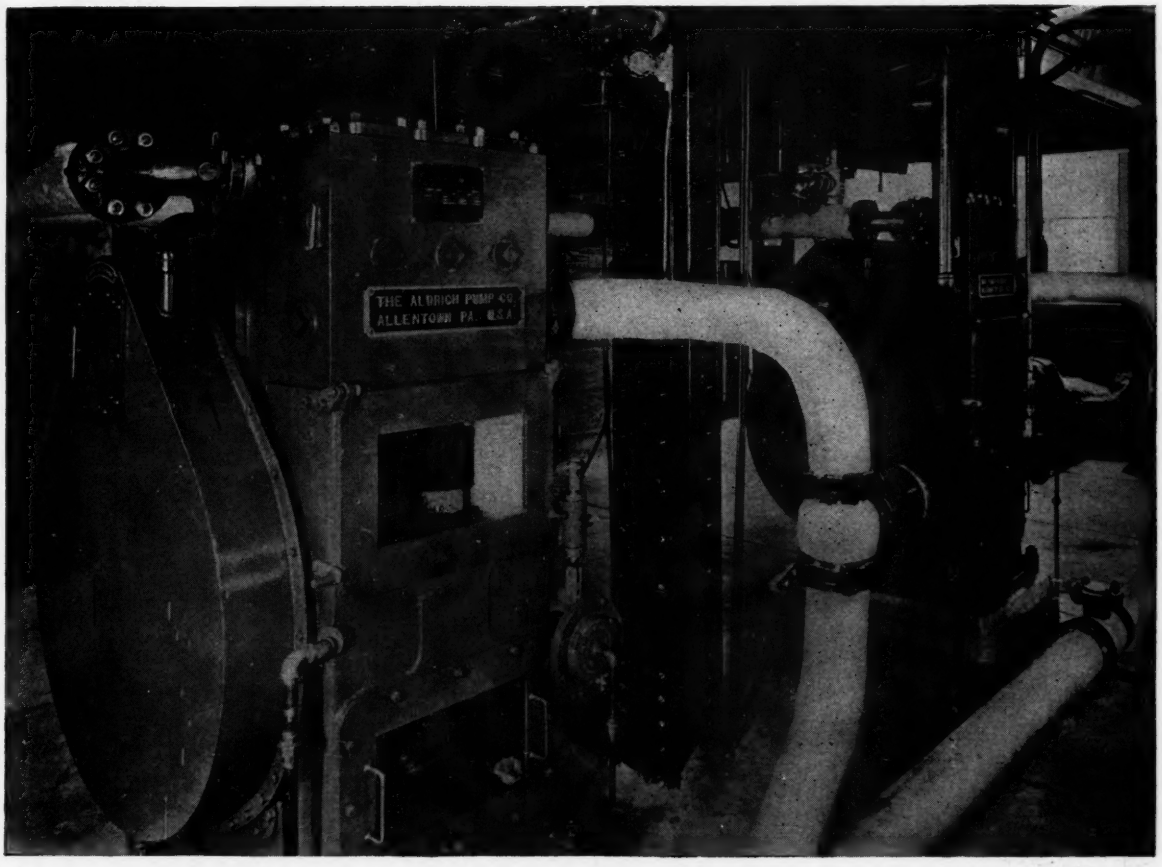
THESE ALDRICH-GROFF "POWR-SAVR" PUMPS...

TRADE MARK



... hold boiler water levels to close limits!

Typical Steam Flow Chart for a 24-hour period showing the widely varying steam demands from boilers fed by Aldrich-Groff Controllable Capacity "Powr-Savr" Pumps in a large eastern brewery.

EVEN with the widely fluctuating steam demands as indicated in the steam flow chart at the left, two ALDRICH-GROFF Controllable Capacity "Powr-Savr" Pumps have automatically maintained boiler water levels within one inch of the desired point as consistent practice during the more than 2 years of their operation to date. Each of these 0-to-4" *variable-stroke* vertical triplex pumps is driven by a 20-HP constant speed motor and feeds *one* 40,000-lb. per hr. boiler, with power consumption almost directly proportional to pump delivery.

The use of these pumps with *unit feed systems* eliminates the pressure and power losses associated with throttling-type feed-regulating valves. The pump offers the advantages of feed system simplicity, efficiency and mechanical reliability for the small and medium boiler plant using medium and high steam pressures, and for *de-superheater feed service* in even the largest power stations.

And at sea these same advantages have called for the installation of Aldrich-Groff "Powr-Savr" Pumps on more than 100 ships.

Write today for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

THE ALDRICH PUMP CO. **7 GORDON STREET ALLENTOWN · PENNA.**

FYR-FEEDER
MULTIPLE SPREADER STOKERS

BURN COAL LIKE OIL!

American Coal Burner Company
18 East Erie St., Chicago, Ill.

Gentlemen:-

I wish to take this opportunity of congratulating you upon the excellent stoker which you have furnished us. We have used your stoker continually for about six weeks, namely, during the time we were putting up our pea pack. This is the time of the year when the greatest stress is put upon men and machinery and I must say that your stoker came through with flying colors.

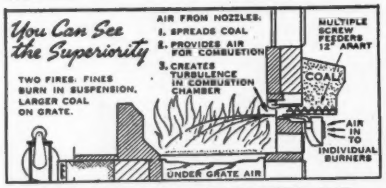
Never before have we had such even steam pressure and such a maximum amount of driving power. Your FYR-FEEDER burns up the coal most uniformly, thereby getting the utmost heat out of the fuel, and leaving very little waste.

Needless to say, this has resulted in a saving for us both in labor and fuel, and at the same time increasing the output which we were so much in need of. I would not hesitate to recommend this stoker to my best friend.

Sincerely yours,
(Large Packing Plant)

Name on request

ACT now to protect yourself against *FUEL SHORTAGE, steam shortage and manpower shortage* in the critical days that lie ahead. WRITE NOW for full details on FYR-FEEDERS.


You Can See the Superiority
AIR FROM NOZZLES:
1. SPREADS COAL
2. PROVIDES AIR FOR COMBUSTION
3. CREATES TURBULENCE IN COMBUSTION CHAMBER
MULTIPLE SCREW FEEDERS 12" APART
TWO FIRES: FINES BURN IN SUSPENSION, LARGER COAL ON GRATE.
COAL
AIR IN YO
INDIVIDUAL BURNERS
UNDER GRATE AIR

MULTIPLE BURNER SPREADERS ARE ADVANTAGEOUS AND NECESSARY

Each FYR-FEEDER has 2, or 4, or more burner spreaders giving dependability and convenience in cleaning grates, impossible to secure with a single spreader.

AMERICAN COAL BURNER CO.
ENGINEERS, Est. 1918
22-18 East Erie St., Chicago, Ill.

Harold Clark

HAROLD CLARK, personnel manager, assistant secretary and assistant treasurer of International Nickel Co., New York, died Aug. 24 in Westfield, N. J. He was also assistant treasurer and assistant secretary of the International Nickel Co. of Canada and the Whitehead Metal Products Co., a subsidiary of International Nickel.

William R. Shiperly

WILLIAM R. SHIPERLY, head of the field service work of the Chaplin-Fulton Mfg. Co., died at his home in Pittsburgh, Pa., Aug. 9. He had been with the Chaplin-Fulton Co. continuously since 1918 and served in various capacities.

Francis J. Arend

FRANCIS J. AREND, founder and president of the De Laval Steam Turbine Co., died Aug. 24 at the Fitkin Memorial Hospital, Neptune, N. J. He was also president of the De Laval Separator Co., a director of the Marine Midland Trust Co. of New York; the Allenhurst, N. J., Bank & Trust Co.; the Arex Indemnity Co. of New York and the Fitkin Memorial Hospital.

William R. Elden

WILLIAM ROBERT ELDEN, manufacturers' representative of New York City, died in a Teaneck, N. J., hospital on September 2 at the age of 59. Following his graduation from Purdue University in 1905, Mr. Elden was a sales engineer for Lidgerwood Mfg. Co. until 1921, when he joined Sauerman Bros., Inc. of Chicago, where he remained as chief engineer until 1939. In 1939 he opened his own office in New York City to represent Sauerman Bros., Inc. and other manufacturers of material-handling machinery. At the time of his death his home was in Bogota, N. J. Besides his widow he leaves a son, Lieut. W. R. Elden, Jr., U. S. Army, and two sisters.

NEW ENGINEERING BOOKS

What Can I Do; The Citizen's Handbook for War. This is an official compilation of the various opportunities for volunteer war work and was prepared in response to thousands of requests for guidance from people.

Copies may be obtained from state and local councils of the Office of Civilian Defense. Chapter I tells what everyone can do to help win the war, and succeeding chapters suggest particular work for some 73 occupations and groups. There is a chapter on specific jobs for women and one devoted to what boys and girls can do. The pamphlet does not attempt to give cut and dried rules for fitting each individual to a particular job, but suggests lines along which people can put their initiative and imagination to work.

TRIPLE ACTING NON-RETURN VALVE

★

This valve will automatically cut in a boiler whenever its pressure equals line-header pressure; it will isolate a boiler automatically whenever its pressure, from any cause, is lower than line-header pressure; and it will prevent steam flow from the boiler in event of sudden drop of line-header pressure below the boiler pressures, by means of differential shot pilot valve functioning.

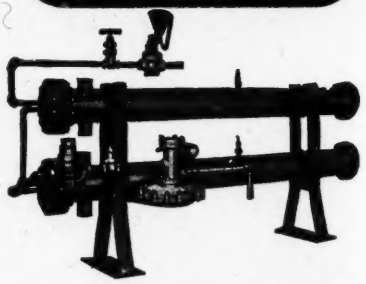
★

Furnished in angle, globe and elbow patterns, sizes 2½" to 12"; also available in larger sizes, as well as in the Cross pattern.

Write for Specifications

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

HENSZEY



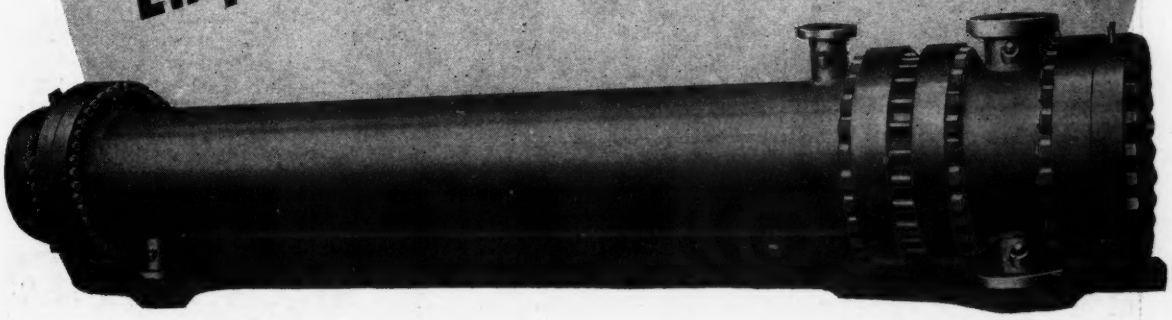
CONTINUOUS BLOWDOWN

The Henszey system continuously and automatically draws off the trouble-making impurities of the boiler water —keeping them well below a predetermined "safe point." Priming, foaming, carryover and (with simple chemical treatment) scale are prevented. This system in operation enables your boilers to produce at maximum capacity for longer periods between shutdowns —enables you to produce the great volume of clean steam needed for war production.

Send for descriptive bulletin.

HENSZEY COMPANY
Dept. C10, Watertown, Wis.

FEED WATER HEATERS ... In All Pressure Ranges Employed in Modern Power Plant Design



In numerous power plants, feed water heaters of Lummus design and construction are operating at pressures up to 1200 pounds. Lummus heat exchangers of the same type of construction are operating at pressures up to 2200 pounds.

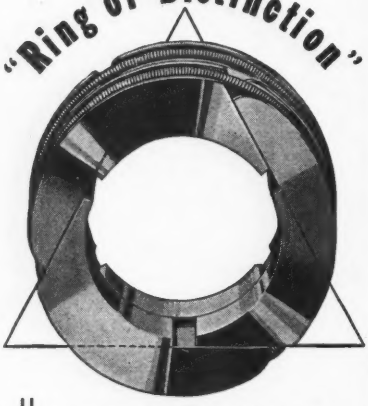
In addition to feed water heaters of improved design, Lummus offers public utility and power plants, surface condensers, evaporators, ejectors and similar equipment to meet specific conditions. Write for further information.

THE LUMMUS COMPANY · 420 LEXINGTON AVE., NEW YORK, N.Y.

LUMMUS

FEED WATER HEATERS

"Ring of Distinction"



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Metal Packing
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Production

The renewal of ordinary packing every few weeks or months increases horsepower and production costs.

Minimum friction is encountered with France Metal "Ring of Distinction" Packing. No undue force can be exerted on rods or stems by tightening the stuffing box stud nuts. The rings are free to float in the case that retains them and are held to the rod or stem with a garter spring having minimum tension.

The result is tight "full-floating", trouble-free performance for years. Prompt delivery assured.

FREE

44-page Catalog of useful and valuable information. Write for your free copy of Catalog M-5, with facts on

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- Installation Procedure
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Request France Engineers to analyze your packing requirements. There is a representative close at hand.

THE FRANCE PACKING COMPANY
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Original
FRANCE
METAL PACKING

Conversion—How to Go After War Work. This is a 24-p., 10½ by 14 in. bulletin prepared and distributed by the Division of Information, War Production Board, Washington, D. C. It tells the steps to take in seeking war work, the agencies to be consulted, and gives the address of local offices and Federal procurement agencies throughout the country. The major portion of the book is a pictorial guide devoted to case studies of specific plants which have switched over to new business, dental instruments to shell fuses; automobile manufacturing to plane parts and tanks; window screens to engine cowlings; lingerie to mosquito nets; freight cars to prefabricated ship assemblies; compacts and watch cases to shells, etc. Much of the work illustrated is being done on subcontracting and by production pools.

Electronics. By Jacob Millman and Samuel Seely. First Edition. 699 pp. Size 6 by 9 in., cloth bound, illustrated. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. 1942. Price $5.00.

Coordinating the physical theory of electronics and the theory of operation of electronic devices, this book systematically presents a clear and well-rounded explanation of basic electronic principles together with their application to many problems in electrical engineering and physics.

The book is an outgrowth of a course in electronics that the authors have been giving for more than five years to electrical engineering students. Both authors are of the Department of Electric Engineering in the School of Technology at the College of the City of New York.

In presenting the material the authors consider the theoretical and practical aspects of electronics side by side with the point of view of either the physicist or of the engineer predominating, depending upon which is the more appropriate for the particular topic under survey. In many cases the dividing line between these two viewpoints is very indistinct and it is the object of the text to merge these two viewpoints even closer together.

Although the book covers the subject of electronics from the beginning, it presumes a working knowledge of the basic principles of alternating current, including elementary Fourier analysis. Also it is assumed that the student is familiar with the calculus and with elementary differential equations.

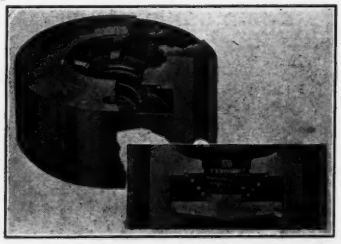
Perhaps the best idea of the scope of this book can be obtained from the chapter titles. These are as follows: 1 Introduction. 2 Motion of Charge Particles in Electric and Magnetc Fields. 3 Application of the Motion of Particles in Applied Fields. 4 Electrons in Metals. 5 Phenomena at the Surface of Metals. 6 Characteristics of Thermionic Cathodes. 7 The High Vacuum Diode. 8 The Kinetic Theory of Gases. 9 Fundamental Processes in Gases. 10 Electrical Discharges in Gases. 11 Commercial Gas Tubes. 12 Rectifiers. 13 Controlled Rectifiers. 14 Filters for Rectifiers. 15 Photoelectricity and Photoelectric Cells. 16 Triode Characteristics. 17 Triodes as Circuit Elements. 18 Multielectrode Tubes. 19 Voltage Amplifiers. 20 Audio Frequency Power Amplifiers.

DE LAVAL-IMO PUMPS

FOR its production of IMO pumps and other marine equipment, permission has been awarded to the De Laval Steam Turbine Company to fly the Navy "E" burgee, emblem of outstanding excellence, and to De Laval employees to wear the Navy lapel insignia in evidence of work "Well Done."

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey

WILLIAMS-HAGER
Flanged Silent Check Valve



- Non-Wear Conical Spring
- Renewable Disc and Seat
- Works In Any Position
- Noiseless In Operation
- Protection Against Water Hammer

These improved side-guided check valves stay tight under every condition of service and pressure. Easily installed between flanges and readily removed for inspection. Sizes up to 20 in. and for pressures to 6,000 lb. They will handle all liquids, hot or cold—water, oil, gasoline, chemicals, etc. Get further details about this economical protection for pumps and service lines.

Ask for Catalog No. 142

THE WILLIAMS GAUGE CO.
3000 Pennsylvania Ave., Pittsburgh, Pa.

Bartlett-Snow
WEIGH LARRIES
—make it possible to keep an accurate record of the coal being fed to each boiler—prevent the segregation of coal—and permit an entire row of boilers to be supplied from a single bunker located at the end or entirely outside the building, resulting in substantial savings in building and bunker costs. Hand propelled and motor driven types in capacities from ½ ton to 20 tons per single trip. Eng. Bul. No. 83 sent on request, gives full details. The C. O. Bartlett & Snow Co., 6258 Harvard Avenue, Cleveland, Ohio.

GUARD AGAINST LOSSES *in production time*

Avoid delays by using a Castable Refractory, made with LUMNITE, for refractory maintenance

HERE'S a way to reduce boiler "time-outs" and lost horsepower hours! For your refractory maintenance and replacements specify and use Castable Refractories made with LUMNITE.

If you need a new door lining . . . a cast-in-place baffle or wall patch, or a special refractory shape *in a hurry,* here's all you do. Get a Castable Refractory (a dry mixture of refractory aggregates and LUMNITE). Add water to the mixture, right on the job . . . pour it in a simple form. It quickly gains high cold-strength and is ready for service in 24 hours. No waiting . . . no delay . . . no production time out.

Castable Refractories are as easy to handle as ordinary concrete. There's no cutting or fitting . . . no ramming . . . practically no shrinkage in drying or firing. They're not affected by steam or moisture. Have high resistance to spalling. Upkeep costs are low.

Specify Castable Refractories made with LUMNITE. and you get a balanced, always uniform product, made with carefully selected aggregates and the hydraulic binder which made Castable Refractories possible.

Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors. They should be used according to the manufacturer's direction.

The Atlas Lumnite Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Building, N. Y. C.

FOR THE ENGINEER'S LIBRARY

Coupon for obtaining free literature listed here may be found on page 178, under the heading Helpful Bulletins.

INSTRUMENTS AND CONTROLS

1 **Instruments**—Catalog 95-A on modern instrumentation describes a full line of instruments for the measurement and control of industrial process conditions. 48 p. comprise ten sections grouping and describing instruments, accessories and supplies appropriate to a particular field of application, such as temperature, flow, pressure, level, humidity. Also included are sections on valves, instrument panels, and similar subjects. The Foxboro Co.

2 **Electrical Instruments**—A new 8½ by 11 in., 12-p. Catalog 4120, has been issued describing .3 and 4 in. panel instruments. Various types of cases are illustrated, dimensions and listings of a complete line of shunts are given and RT current transformers for ratios up to 500/5 are illustrated and described. Roller-Smith Co.

3 **Instruments**—Two new precision balances for accurate and rapid repeated weighings of small particles ranging from less than 3 mg. to more than 50 gr. are described, illustrated and listed in Catalog 4550. Included is information on the application of the balances, how weighings are made, and how to select the correct range of balance best suited to the weighing application, and a complete listing of the various balances available. Roller-Smith Co.

4 **Instruments**—An 8-p. booklet entitled Your Own Inspection Laboratory has been released recently. Its aim is to assist war production plants, both large and small, in the selection of equipment for the establishment of an inspection department. The booklet covers briefly the use of gage blocks, comparators, projectors and other inspection department essentials. George Scherr Co.

5 **Instruments**—Various centrifugal tachometers are described in a recent 4-p. bulletin. Specifications and applications with illustrations, are included. Speeds range from 100 to 12,000 r.p.m. in a wide variety of models and dial sizes. Boulin Instrument Corp.

6 **Automatic Time Control**—Catalog B10, an 8-p. catalog, illustrates and describes Series 2800 Vernier-Set and Cycle-Progress Timers used for speeding up production by automatically controlling process schedules and machine operations. Included are wiring diagrams, tables, electrical data and case drawings. Automatic Temperature Control Co., Inc.

WANTED

A PLANT ENGINEER

by well-known

Food Manufacturer

Old established concern specializing in packaged dehydrated baking mixes requires the services of a plant engineer qualified to overhaul and speed up production.

A real future is in store for the right man. He may be employed somewhere at present as an assistant but looking for a chance to prove his worth as production chief. Or he may be presently unemployed because of war conditions. Or he may be a top flight plant engineer already holding down a good job but looking for new worlds to conquer.

We have a lot of problems due to substantial increase in business and will move promptly and generously if the right man answers this advertisement. Let's hear from YOU. State experience, present salary and salary desired. Address in full confidence:

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38 East 37th Street, New York

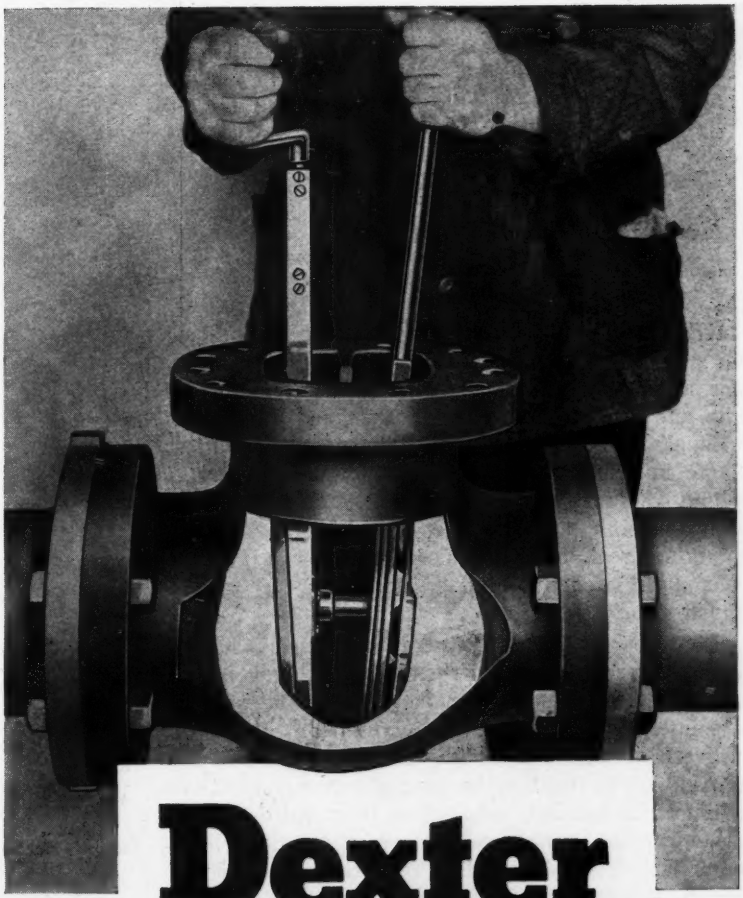
Help Wanted

ENGINEER—Eastern manufacturer of recording and control instruments desires to employ a power plant application engineer. Applicants should be familiar with the practice and theory of central power plant processes, including combustion, and with the construction and use of available instruments and control devices. Must be capable of visualizing needs for instruments and control devices not yet available on the market. A good education in physics or in chemical engineering considered essential. Applicants must be U. S. Citizens. Reply C-15, P. O. Box 3495, Phila., Pa.

Reliable Buying Bulletins

In these pages you will find advertisements of firms that make every type of machinery and equipment for generating, distributing and utilizing power. Their messages constantly record latest progress in power plant equipment. They tell you who makes it, who stands behind it. Consider their advertisements as convenient and reliable buying bulletins.

RESEAT VALVES
PRESSURE TIGHT



While They're ON THE LINE with DEXTER Valve Reseating Equipment

Without removing them from the line, ANY valve of any make can be quickly reseated . . . eliminating the risk of shut-downs from leaky valves. And *after* being reseated with Dexter Equipment, the valves will be *pressure tight.*

It doesn't make any difference what kind of metal a valve is made of, since Dexter Cutters are available for monel, stainless or stellite, bronze or brass.

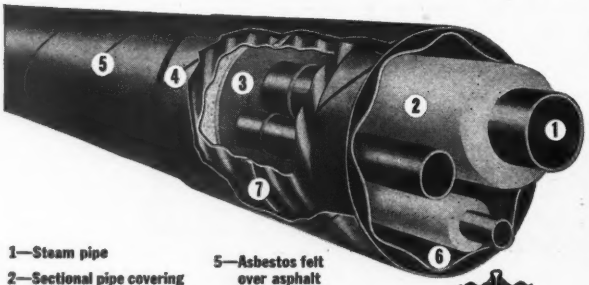
Dexter Valve Refacing Equipment quickly pays for itself by putting an end to leaky valves and bringing "junked" valves back to life. No plant should be without this equipment. Order yours today.

Capacities: Globe valves, ¼" to 14"; Gate valves, 1½" to 48"; Pump valves, 1½" to 15"

THE LEAVITT MACHINE COMPANY
410 EAST RIVER ST., ORANGE, MASS.

Dexter
Valve Reseating Machines

RIC-WIL PRE-FABRICATED INSULATED PIPE UNITS—WITH CONDUIT AND PIPE CONNECTIONS *WELDED*—GIVE A *SUPER-QUALITY UNDERGROUND PIPING JOB!*



1—Steam pipe
2—Sectional pipe covering
3—Pipe support
4—Thick strip asphalt applied after welding
5—Asbestos felt over asphalt coated Hel-Cor
6—Air space
7—Butt welded connection

FLANGE WELD
BUTT WELD
LAP WELD

Butt-welding Hel-Cor conduit connection between units.

Welded split elbow conduit fitting.

THE supremacy of welding, as the modern technique for many types of fabrication, is universally recognized. For an air-and-water-tight connection on both pipe line and conduit—use Ric-wiL Insulated Pipe Units with all-welded connections! Formed in the hottest flame known to man, such a joint stands any test within reason. Illustrations show various types of welds possible, and how these welds are made. For a perfect seal, for permanence, and for a joint of maximum strength, nothing is superior to welded construction.

Ric-wiL factory pre-fabricated, pre-sealed Insulated Pipe Units are today's answer to wartime demands for a thoroughly protected and insulated piping system, absolutely *ready for quick installation.* Units are delivered complete including the steam pipe, in approximately 20 foot lengths, for underground or outside overhead steam, hot water, or oil lines. All expansion loops, conduit fittings, anchors, watertight glands, and other accessories can also be furnished ready to install. Units are pre-insulated to your specifications. For full information on Ric-wiL welded and other types of piping systems, write for latest Bulletin 4208.

Engineers on Defense Work Only! Write on your letterhead for Professional Engineering Manual 420A.

RIC-WIL CONDUIT SYSTEMS
THE RIC-WIL CO., CLEVELAND, O.
Agents in Principal Cities

7 Flow Meters—A new 56-p. edition of Cochrane's complete flow meter line describes electric, mechanical, linameter (area), ring balance, liquid level and weir meters. Also covered is the new 2 pen electric flow recorder with ratio indicating pointer, an improved low-pressure (1 to 10 in. water differential) electric type meter, and the ultra high-pressure (6000 psi.) ring balance meter. Well illustrated, the catalog also includes a discussion of flow metering benefits and complete listings of specifications and ranges. Cochrane Corp.

ELECTRICAL EQUIPMENT

8 Switches—Bulletin 600 describes manual starting switches for motors rated up to 1 hp., 110-220 v. a.c. and ¾ hp., 115-230 v. d.c. These switches are designed for starting and overload protection of small motors used in unit heaters, stokers, refrigerating machines, fans, pumps, compressors, small machine tools, etc. Allen-Bradley Co.

9 Switchgear—Unitized metalclad switchgear using De-ion air breakers, with an interrupting capacity of 100,000 to 250,000 kv-a. for central station, industrial and commercial use, are described in a new 33-p. booklet B-3036. The switchgear consists of 19 basic units rated at 2500 to 5000 v. and 600 to 2000 amp. The units are illustrated and fully described with diagrams showing requirements for various applications. Complete specifications, for each unit, are included. Westinghouse Elec. & Mfg. Co.

10 Electrical Equipment—Save Copper—Get More Capacity Quickly is the title of 6-p. folder on indoor and outdoor type C-D Dykanol capacitors. This timely bulletin weighs a familiar plant problem, overtaxed electrical systems, insufficient line, transformer and switching equipment capacity. Also presented is a solution said to boost factory output while saving all-important time, materials and labor. Cornell-Dubilier Elec. Corp.

11 Automatic Voltage Starters—A 16-p. bulletin describes automatic reduced voltage starters and also contains a complete discussion of the factors that enter into the selection of automatic reduced voltage starters for squirrel cage motors. Included is a description of Allen-Bradley Bulletins 740, 741, 742, 746, and 747 automatic resistance starters of various types and sizes. Allen-Bradley Co.

BOILER PLANT EQUIPMENT

12 Boilers and Tank Equipment—40-p. Catalog No. 10 describes various boiler and tank accessories. Included with the accessories are specifications, test data, construction details, dimensions, typical installations and other technical data. The Steel Improvement and Forge Co.

13 Furnaces—The application of recirculating and convection type furnaces to the ship, tank and plane industry is described and illustrated in a 6-p. bulletin, Form SC-103. Surface Combustion.

14 Furnaces—Various types of standard rated industrial furnaces are described in Form SC-102, an 8-p. bulletin. Specifications and application data are included with illustrations and construction details. Temperature ranges are from 300 to 2650 deg. F. in the various furnaces. Surface Combustion.

15 Coal Equipment—Bulletin 342 describes and illustrates the mechanical principles of coal crushers and breakers in relation to the crushing and breaking of coal sizes. Included are capacity and dimension charts and construction features. McNally Pittsburgh Mfg. Corp.

16 Vibrating Screens—Suspension of screens, slope of screening surface, construction and application of vibrating screens together with illustrated features are described in 12-p. Bulletin No. 122. Robins Conveying Belt Co.

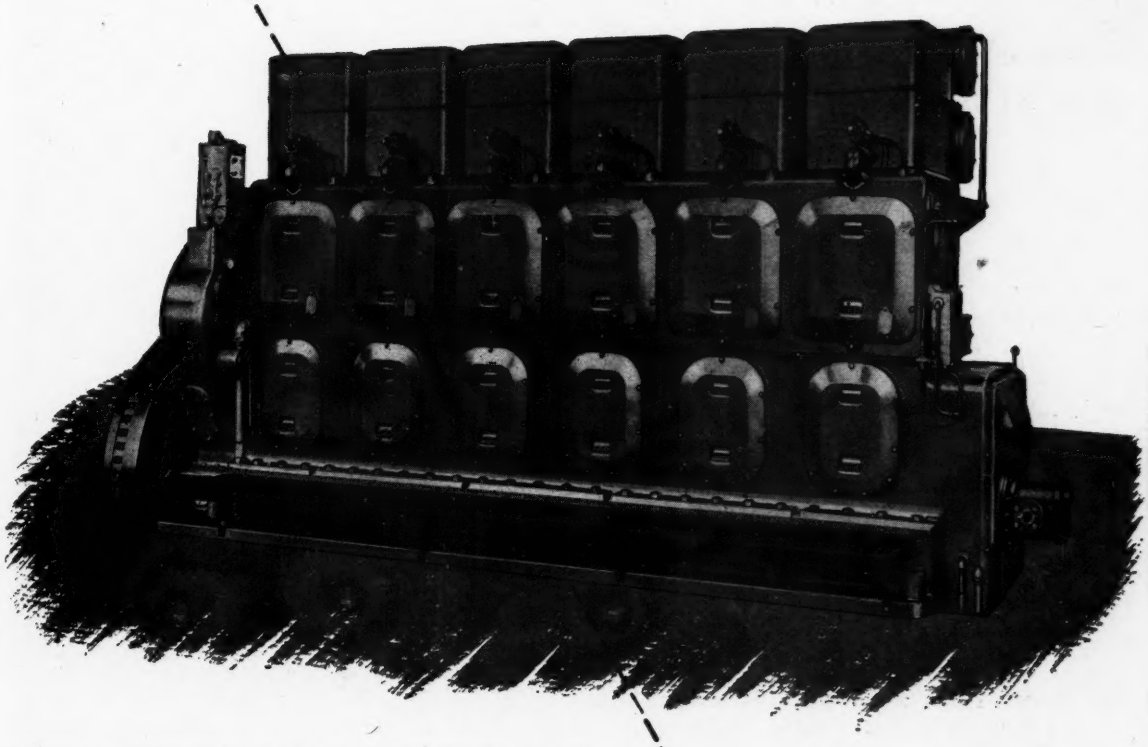
COMPRESSORS, PUMPS AND BLOWERS

17 Compressor Maintenance—A conveniently arranged booklet on maintenance hints for 2-cycle gas engine driven compressors deals briefly with proper maintenance of units and troubles encountered by operators and gives methods for solving them. Also included is a list of do's and don'ts that should be useful to plant engineers and maintenance men in reducing maintenance and repair costs. Clark Bros. Co., Inc.

18 Centrifugal Pumps—2-stage single-suction type centrifugal pumps of the opposed impeller design are described in a 12-p. catalog B-3. This type of pump is listed for capacities from 50 to 1500 g.p.m. and for heads from 80 to 800 ft. De Laval Steam Turbine Co.

DEPENDABLE POWER

De La Vergne Diesel Engines



Today's production requirements demand uninterrupted power supply. World conditions make it imperative that every possible safeguard be taken to prevent power failure.

Your best insurance for an uninterrupted power supply is a De La Vergne Diesel Engine. Known throughout the country for their dependable and economical operation, De La Vergne Diesels are available in sizes from 200 bhp to 1,500 bhp. Let De La Vergne engineers investigate your power problem.

Baldwin De La Vergne Sales Corporation, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, California.

BALDWIN

De La Vergne

SALES CORP.

BLW THE BALDWIN GROUP

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

BUILDERS OF DEPENDABLE ENGINES SINCE 1880

PIPEWRENCH PETE SAYS:

Here's NEWS about CONTINUOUS BLOWDOWN

NEW ACCURACY, NEW ECONOMY!

NEW ACCURACY! Visual metering, plus restricted seat.

NEW ECONOMY! Anum-Metl "X" seat and disc last longer than Anum-Metl!

SHOWN: Strong Type SOCBX Valve. List prices: ½"—$20; ¾"—$24.75; 1"—$31.00 (And well worth it!)

NEWEST MEMBER OF STRONG LINE HAS BEEN SELLING ITSELF!

Before this announcement, we made sure that Strong's Continuous Blowdown valve had earned its place in Strong's complete line of valves. Developed two years ago, it sold itself—first proved its advantages in important installations, so you can buy it today with confidence!

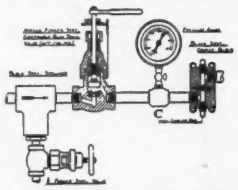
Its Anum-Metl "X" seat and disc offer almost diamond surface hardness—750 Brinell. For less severe usage, regular Anum-Metl lasts up to 8 times longer than the long-lived metal it replaced.

Call your distributor or write for Catalog 101 on Strong's full line of valves for severe service!

* * * *

CATALOG 176 — Strong boiler feeders and liquid level controls. Features non-liming, Anum-Metl seats and discs.

"VOLUMETERING" HOOK-UP



Combination of valve and fixed orifice results in pressure drop and increase in blowdown volume at C. Gauge shows pressure drop, permitting visual control.

Strong, Carlisle & Hammond Company
1392 West Third St., Cleveland, O.

A

STRONG
STEAM SPECIALTIES

19 **Blowers**—Rotary positive blowers are covered by 20-p. Bulletin 22:23-B-11, which includes a brief historical account of the principle as patented by the Roots brothers in 1859; curves with a discussion of the operating principle of the blowers; shop views of the different types of gears and gear cutting operation; typical installation views in diversified industries; typical accessories; specifications and tables of sizes, capacities, speeds, etc. Roots-Connersville Blower Corp.

VALVES, PIPING AND FITTINGS

20 **Pump Strainers**—Bulletin 400 covers the Blackmer line of Ezy-Kleen strainers. The text of the bulletin stresses the importance of protecting pumps, through the use of strainers in the intake lines, and illustrates with cross-sectional views and describes the operation of various types of strainers. Blackmer Pump Co.

21 **Valves**—How to Repair Valves is the title of a bulletin on piping pointers which explains and illustrates the various steps to take in repairing leaky gate and globe valves, as well as hints on how to reclaim discarded valves. Crane Co.

22 **Butterfly Valves**—A 4 p. bulletin features butterfly valves having sufficient face-to-face dimension to permit the mounting of ball bearings for high pressure service. Included are tables of dimensions for raised face or ring joint flanges and illustrations of the uses to which the valves are adaptable. R-S Products Corp.

23 **Spray Nozzles**—Bulletin 409 illustrates and describes various uses of Rex spray nozzles which range from cooling fruit in packing plants and cleaning trolley buses in garages to washing logs in lumber mills or descaling sheets and plates in steel mills. Chain Belt Co.

24 **Copper Tubing** — Industrial application of Anaconda copper tubing and fittings is the theme of an attractive 64-p. spiral bound catalog. Included are illustrated and described applications—pipe lines in mills and plants, tubing in refrigerating and air conditioning equipment, mechanical uses, and plumbing and heating equipment. The American Brass Co.

25 **Piping System Equipment** — 20-p. Bulletin 1863 describes the use and advantages of functional pipe hangers and vibration eliminators in piping systems. Well illustrated, the bulletin also includes types and characteristics of various hangers and the application of vibration eliminators to insure controlled vibration. Also included with the bulletin are additional loose-leaf Flex-Anal charts which provide the piping designer with a quick, accurate method for the flexibility analysis of any piping systems. Power Piping Division, Blaw-Knox Co.

METALS

26 **Bearing Metals**—A timely bulletin on substitute bearing metals describes various lead-base metals which have been found exceptionally long-wearing on shock loads, on heavy sustained pressures, and on general service, and have proved to be excellent substitutes for tin-base bearing metals. Also included in the bulletin are practical suggestions for best results in making and maintaining journal bearings, and a table of recommendations for selecting the correct type of bearing metal for 135 different types of machinery. Magnolia Metal Co.

27 **Metal**—The use of Ampco metal alloys in aircraft construction and assembly is the theme of an 8-p. catalog entitled, How Aircraft Designing Engineers Use Ampco Metal. Ampco Metal, Inc.

28 **Machining Aluminum**—A 44-p. booklet sets forth the general principles of machining aluminum and its alloys, and suggests speeds, feeds, and depth cuts which will produce most satisfactory results. Practices and tools common to other metals are compared and information on general machine shop methods are discussed. Aluminum Co. of America.

MISCELLANEOUS

29 **Mounted Wheel Accessories**—A new booklet on the use of mounted wheels and accessories for portable tools has been released. Included is information required for fitting mounted wheels to the job, a selection guide on the use of mounted wheels covering every conceivable material and most important war operations, a wide variety of portable tool accessories including miniature steel cutters, polishing wheels, sanding drums, discs, and many other production time-savers. Chicago Wheel & Mfg. Co.

COAL

Convert Now — for Victory!

Good engineering is most essential in making conversions from oil to coal fuel. The penalties of poor engineering and a make-shift job are too great. The life of the plant depends on the changeover being skillfully done.

Failure to conform to good engineering standards and practices affecting burning rates, heat release, combustion space, radiant heat, boiler baffling, drafts, coal and ash handling equipment, will reduce capacity and make an invalid out of the plant.

Because of the critical fuels situation the conversion job should be designed to give maximum latitude in coal selection. It must be recognized that the majority of coals available fall in the low or medium ash fusion range.

The Pittsburgh Seam Coal in the Fairmont Region of West Virginia, with its [illegible] reserves and expanded mining facilities, is a great fuel arsenal for conversion plants. Learn more about this Victory fuel by requesting a copy of the brochure "Coal."

In planning conversions, draw on the experience of the Bureau's staff of Fuel Engineers.

We Invite Your Inquiries

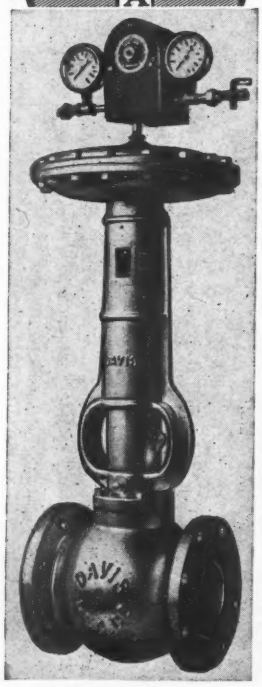
COAL BUREAU

UPPER MONONGAHELA VALLEY ASSOCIATION

Peoples Building — Fairmont, West Virginia

PRESSURE REGULATORS

for Every Purpose



. . . . No. 401 for Pressure Reducing . . . Relief . . . Back Pressure Service. (LEFT) The Davis No. 401 is a rugged, compact regulator for use indoors or outside where conditions demand accurate, sensitive pressure control. Adjustment can be quickly made to change the No. 401 from direct to reverse-acting without dismounting or changing valve action. Pilot-operated pressure controller insures positive pressure control at all times, and a simple setting on the face of the controller changes the pressure reduction or relief pressure as desired. Operation is simple, insuring long, trouble-free life and low maintenance.

Davis No. 401 is available in sizes from ½ in. to 10 inches in steel, semi-steel or bronze body, with bronze monel or KA2 trim. For initial pressures up to 600 lbs. and reduced pressures from 1 to 500 lbs.

No. 40 for Heavy Duty Variable Load Conditions. (RIGHT) No. 40 is a self-contained, pilot operated type reducing valve for handling heavy duty, variable load conditions. Unaffected by high pressure fluctuations, pressure reduction is maintained regardless of flow conditions. Full pipe size port area gives large capacity; single seat insures tight closing. Sizes from ½" to 10". Available in materials suitable for any pressure up to 400 lbs.

GETTING the right regulator for the job is easy when you make selections from the Davis line: eighteen different types to choose from . . . Sizes up to 24" . . . for pressure up to 1500 lbs. . . . for steam, gas, air, water, or oil. Ask for handy "Service Selector Chart" and complete information. DAVIS REGULATOR CO., 2508 S. Washtenaw Ave., Chicago, Ill.

DAVIS REGULATOR CO.

30 Graphite Lubrication—A 16-p. booklet titled Plant Engineer's Handbook deals with the application of Cograph, a colloidal graphite in making, lubricants more effective. Included in the booklet is an alphabetical index listing machinery parts needing lubrication with a Cograph remedy. Nassau Laboratories.

31 Steam Generators—A colorful loose leaf catalog illustrates and describes the Vapor Packaged Steam Generator, which is applicable where a steady source of steam is demanded or as an emergency unit. The catalog also includes several types of valves (reducing, motorized, shut-off and safety); traps; metallic joints; thermostatic controls; a motorized valve and damper; heat exchanger; a command alarm, stratomotor and thermo-balancer (a newly designed cooling system thermostat) that sets a new standard in controlling gas and Diesel engine operating temperatures. Vapor Car Heating Co., Inc.

32 Welding Positioners—An informative, well illustrated 16-p. Bulletin WP-22 describes the practice of welding on positioners. Typical welding jobs with descriptions of position welding methods are included. Cullen-Friestedt Co.

33 Unit Heater—An 8-p. catalog, describes the new cast iron Grid Unit Heater. It contains capacity tables on the six models, a typical hook-up diagram and dimension diagram, with details of construction. D. J. Murray Mfg. Co.

34 Vibration Screens—Bulletin No. 123 illustrates and describes applications of liquid vibrating screens for removing free liquid and reducing moisture content of sludges, slurrys and pulps; for rinsing and washing solubles and undesirable fine material from coarse solids; and for classifying and separating certain size fractions from a fluid mixture. Robins Conveying Belt Co.

35 V-Belt Handbook—Plain Facts on Wartime Care of Rubber V-Belts is the title of a 16-p. booklet which aims to make complete sense of the entire V-belt maintenance story. It begins with the anatomy of a V-belt and principle of the V-belt drive and ends with post-mortems on actual damaged V-belts. How the anatomy of a V-belt affects its maintenance, how to obtain proper V-belt tension, what to do about worn sheaves, what determines the life-expectancy of V-belts, etc. Allis-Chalmers Mfg. Co.

36 Dust Collectors—High efficiency dust recovery is described in a 28-p. catalog which gives technical aspects, efficiency charts, illustrations, applications in industry, and effectiveness of the double eddy current in the van Tongeren system of industrial dust recovery. Buell Engineering Co., Inc.

37 War Production—A 24-p. booklet on war production gives a highlight summary of General Motors role in turning out vital war materials. Well illustrated, the booklet also portrays the application of the materials to the Nation's War Effort. General Motors Corp.

38 Resurfacing Compound—A repair and resurfacing compound for concrete, marble, wood, stone, etc., is described in a 2-p. pamphlet. The compound can also be used for waterproofing, damp proofing and patching. Central Paint and Varnish Works.

39 Heating Equipment—Thermex high frequency electrostatic heating equipment is described in a 24-p. booklet. Dealt with are problems involving the heating of non-conducting materials, such as wood, fibre, rubber, grain, cork, heat insulating products, etc. Thermex Division, The Girdler Corp.

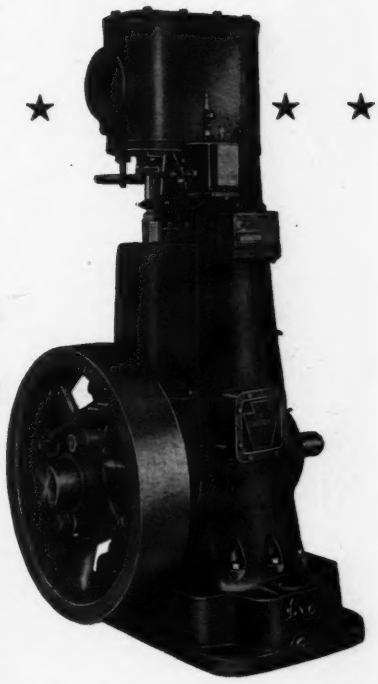
40 Degreasing Solvent—Two recently released leaflets describe the high stability of solvent degreasing and alkali cleaning under adverse operating conditions. Well illustrated, the leaflets give information on the inflammable chlorinated solvents which can be used for cleaning all kinds of metal parts. Detroit Rex Products Co.

41 Steel Flooring—Kerlow Steel Flooring is the title of a 4-p. folder showing the construction and application of the various types of flooring built by the company and giving data on the proper method of installation of standard fasteners, and safe load tables. Kerlow Steel Flooring Co.

42 De-Scaling—A new 24-p. revised and enlarged fourth edition manual dealing with cleaning and de-scaling methods should be of particular timely interest to power plant superintendents, engineers or other maintenance men having these responsibilities. The manual concisely reviews modern, economical methods for safety, effectively removing carbonized oil, sludge, lime-scale and rust deposits from many different types of water-cooled or water-circulating equipment to maintain heat transfer efficiency. Among the

TROY-ENGBERG AUXILIARY POWER

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★



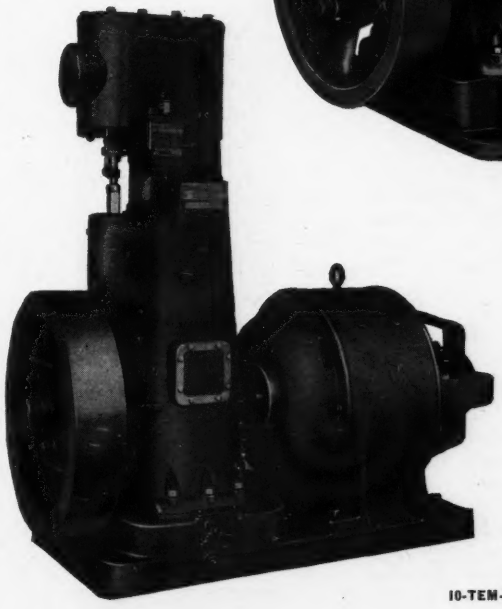
Afloat . . . on our bridge of ships
Ashore . . . in countless factories

IT is significant—but not surprising to those who know what's best in auxiliary power aboard ships—that Troy-Engberg D. C. Generating Sets have been specified and are being furnished to hundreds of Liberty Ships. Long ago, these Sets proved their great usefulness and dependability.

The same engine—the Troy-Engberg Steam Engine—that drives the Troy-Engberg Generators is widely used in countless factories and power plants for driving blowers, fans, compressors, stokers, pumps, etc.

These engines are exceptionally dependable, some of them being in service for fifteen to twenty years without need for major repairs. Power cost is very low, as evidenced by a survey of forty odd plants which showed an average cost at the drive shaft of only ½ cent per kwh. And they have several desirable drive characteristics.

A long record of dependability, economy and serviceability has earned and held for the Troy-Engberg Steam Engine a high place among power engineers and production men.



10-TEM-3

TROY ENGINE & MACHINE CO.

Established 1870
847 Railroad Ave., TROY, PA.

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GET BOILERS BACK TO WORK QUICKER!

You can clean tubes faster with Airetool Tube Cleaners. A unique, newly-developed power seal is the reason. For severe scale conditions, you can use cutter head combinations that will do the cleaning job thoroughly with amazing speed. And all this with no increase in air consumption.

Airetool Motors are slip-fit for rapid reassembling. Wearing parts are of selected alloy steels, carefully heat treated and thoroughly inspected and tested for long lasting ability.

Airetool Tube Cleaners are made for straight or bent tubes ½" to 20" I. D. Cutter, drill, brush or knocker heads are made to combat any type deposit, inside or outside the tubes. Send for Bulletin No. OE-14.

AIRETOOL
MANUFACTURING CO.
SPRINGFIELD, OHIO
Representatives in Principal Cities
New York Address, 50 Church St.

units discussed are Diesel and gas engines, lubricating oil and jacket-water coolers, feedwater heaters, fuel oil heaters, evaporators and transformers. Oakite Products, Inc.

43 **Lift Trucks**—Two recent 8-p. circulars illustrate and describe medium capacity (3000 lb.) industrial lift trucks which are of the tilting fork type, telescopic and non-telescopic. One circular describes the electric powered models, the other, gas powered models. Construction features and applications are included. Lewis-Shepard Sales Corp.

44 **Cranes**—Four circulars illustrate and describe various applications and installations of large and small cranes and hoists. The circulars include general information on design and construction details. The Euclid Crane & Hoist Co.

SPECIAL REQUEST BULLETINS

Steel—A new technical data card, TDC-119, gives complete combined list of standard steels of the American Iron and Steel Institute and the Society of Automotive Engineers, Inc. Copies may be had by writing The Babcock & Wilcox Tube Co., Beaver Falls, Pa., on your company letterhead.

Preheating Data—An 18 by 23¼ in. wall chart entitled Tempil Preheating Chart covers correct preheat temperatures and other pertinent data for 79 principal ferrous and non-ferrous alloys most commonly used in industry. A copy of this chart may be had by writing to the Tempil Corp., 132 W. 22nd St., New York, N. Y., on your company letterhead over the signature of an executive or technician.

Suggestion Systems—Putting Employes' Ideas to Work, based on an analysis of the suggestion system of 34 companies, the Policyholders Service Bureau has recently issued a report on the suggestion systems of companies with long experience in operating such plans and gives a picture of representative policies and procedures.

The report outlines the purposes of a suggestion system and the benefits which contributing companies have cited. Basic policies are described, followed by detailed discussions of clarifying policies adopted to eliminate weaknesses and avoid certain pitfalls. Some of the factors considered are: getting cooperation from supervisors; giving prompt attention to suggestions; determining the eligibility of employes to receive awards and defining what are awardable suggestions. Policyholders Service Bureau, Metropolitan Life Insurance Co., New York.

Use the Coupon to Get HELPFUL BULLETINS

Bring your engineering equipment library up to date. Write in squares below with pencil the bulletin or catalog numbers you desire. Then detach and mail this coupon promptly.

POWER PLANT ENGINEERING October '42
53 W. Jackson Blvd., Chicago

Please have the manufacturers send me, without obligation, the bulletins indicated by numbers.

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Name .....

Title .....

Company .....

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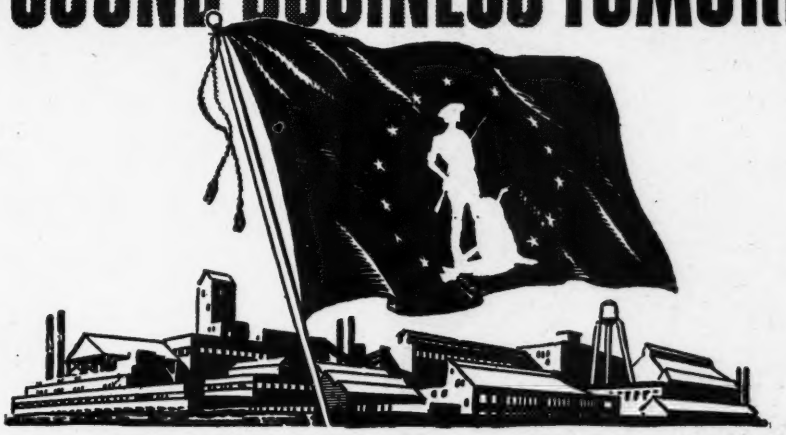
(If you prefer delivery at your home, write address in margin)

FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW



Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

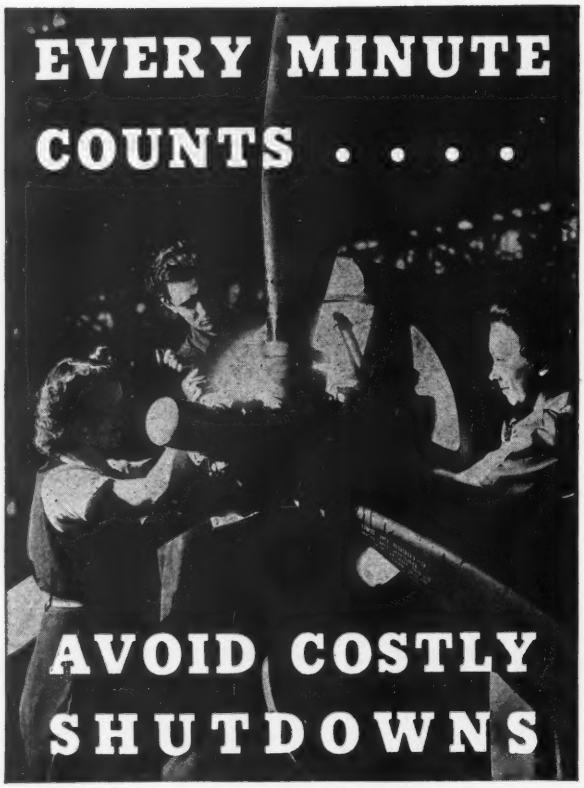
If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

Save With

War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

POWER PLANT ENGINEERING



—*Photo courtesy of Curtiss-Wright Corp.*

● **Every minute counts at Socony-Vacuum Oil Co., Goodyear Tire & Rubber Co., Chrysler, Carnegie-Illinois Steel, DuPont and other war industries where ADSCO Piston-Ring Expansion Joints safeguard steam lines against costly shutdowns.**

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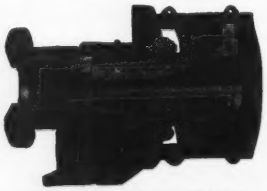

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Power Plant Construction News

Ariz., Phoenix—Aluminum Co. of America, Inc., Gulf Building, Pittsburgh, Pa., plans power plant and several power substations at new aluminum extrusion plant near Phoenix, for production for Government. It will comprise a main manufacturing unit of 2,000,000 sq. ft. of floor space, and group of auxiliary structures. Electric power equipment will be installed. Entire project will cost about $30,000,000, with financing through Defense Plant Corp., Washington, D. C. Work will begin soon. Wyatt C. Headrick, First National Bank Building, Dallas, Texas, is architect.

Calif., San Bernardino—Culligan Zeolite Co., Northbrook, Ill., manufacturer of synthetic gel-type zeolite, chemical products, etc., plans installation of electric power equipment in new plant in vicinity of San Bernardino, where tract of about 50 acres of land has been acquired. It will comprise several one-story buildings. A power house is planned. Entire project is estimated to cost over $225,000. Work is scheduled to begin soon.

Ky., Catlettsburg—Ashland Oil & Refining Co., Ashland, Ky., plans installation of power equipment in new oil refinery for production of 100 octane gasoline for aviation service, on site near Catlettsburg. A power house and pumping station will be built. Entire project will cost about $3,000,000. Output will be used by Government, which will finance project through Defense Plant Corp.

Ky., Louisville—Mengel Co., 1122 Dumesnil St., manufacturer of wooden boxes and other wood products, plans installation of electric power equipment in new plant on local site for production of aircraft parts for Government. Main unit will be one-story, 250 by 700 ft., with several auxiliary structures. A boiler house is planned. Entire project will cost over $1,000,000, with financing provided by Defense Plant Corp. Tietig & Lee, 34 W. Sixth St., Cincinnati, Ohio, are architects.

Mass., Hudson—Light and Power Department has authorized immediate construction of addition to municipal light and power plant, with installation of equipment for increased capacity. No estimate of cost announced. Arthur Nelson, 31 St. James Ave., Boston, Mass., is consulting engineer.

Mass., Worcester—Wyman-Gordon Co., 105 Madison St., manufacturer of drop forgings and kindred products, plans installation of electric power equipment in two new additions to plant, about 50 by 320 ft., and 75 by 100 ft., respectively. Cost close to $180,000. Work is scheduled to begin soon.

Minn., Belle Plaine—Minnesota Valley Milk Processing Co-operative Association, care of Max O. Buetow, 1931 University Ave., St. Paul, Minn., architect, plans power house at new milk dehydration plant in vicinity of Belle Plaine. Main processing and production building will be 1 and 2-story, equipped for large output. Electric power equipment will be installed. Entire project is estimated to cost close to $140,000.

Minn., St. Paul—Armour & Co., Armour Ave., South St. Paul, meat packers, have approved plans for addition to boiler house at local plant. Cost reported over $40,000, with boiler unit and auxiliary equipment. Work is scheduled to begin at once.

Mich., Kalamazoo—Kalamazoo Stove & Furnace Co., manufacturer of stoves, ranges, furnaces, etc., has approved plans for new boiler house at plant, for which work will proceed at once. Cost reported close to $40,000, with boiler unit and accessory equipment.

N. Y., Jamestown—American Aviation Corp., 320 Lexington Ave., New York, N. Y., and Furniture Manufacturers' Building, Jamestown (temporary office), recently organized, plans installation of electric power equipment in new one-story plant at Ellicott, near Jamestown, for assembling of plywood glider-type airplanes. A boiler house is planned. Entire project will cost close to $250,000. Beck & Tinkham, Bailey Building, Jamestown, are architects.

N. Y., Schenectady—Walter Kidde Constructors, Inc., 140 Cedar St., New York, N. Y., affiliated with Walter Kidde Co., manufacturer of fire extinguishers, has contracted with Government for construction and operation of large plant in Schenectady County (exact location and character of production withheld). It will comprise several large

buildings, with power substation and boiler house. Electric power equipment will be installed for industrial service. Cost reported over $2,000,000, with financing through Defense Plant Corp.

Ohio, Ashtabula—National Carbide Corp., 30 E. 42nd St., New York, N. Y., has contracted with Government for construction and operation of new plant in vicinity of Ashtabula for production of calcium carbide and kindred specialties. It will comprise several large processing and production units. Electric power equipment will be installed. A power substation is planned. Entire project is reported to cost close to $3,000,000, with financing provided by Defense Plant Corp. Construction will begin at early date.

Ohio, Cincinnati—American Oak Leather Co., Kenner and Dalton Ave., has authorized immediate construction of addition to boiler house at tannery, with installation of boiler unit, pumps and auxiliary equipment. No estimate of cost is announced. A. M. Kinney, Inc., Enquirer Building, is consulting engineer.

Ohio, Cleveland—Wellman Bronze & Aluminum Co., 6017 Superior Ave., N.E., manufacturer of metal products, has approved plans for enlargement of boiler plant, including installation of additional equipment. No estimate of cost announced. Frank Haushka, Ninth-Chester Building, is architect.

Ohio, Columbus—Columbus Forge & Iron Co., 544 W. First St., has approved plans for new one-story boiler house at plant. No estimate of cost announced. Work will be carried out at once.

Okla., Enid—Champlin Refining Co., Enid, plans installation of power equipment, pressure stills, steel storage tanks, pipe lines and other equipment in connection with rebuilding of portion of local oil refinery, recently destroyed by fire. Loss reported close to $700,000. Proposed to begin work soon.

Pa., Franklin—Keystone Public Service Co., Oil City, Pa., has approved plans for expansion and improvements in power plant at Franklin, with installation of additional equipment. No estimate of cost announced. Work will be placed under way at early date.

Pa., Philadelphia—Heintz Mfg. Co., Front St. and Olney Ave., manufacturer of steel automobile bodies, automobile radiators, etc., plans installation of electric power in new one-story addition, reported to cost over $175,000. Work will be carried out at once.

S. D., Chamberlain—International Minerals & Chemical Corp., 20 N. Wacker Dr., Chicago, Ill., plans installation of electric power equipment in new plant for mining and processing of manganese ore at large deposits in vicinity of Chamberlain. A power house will be built. Output will be used by Government, which will provide financing through Defense Plant Corp. No official estimate of cost announced, but will represent a large investment. Work will be placed under way soon.

Tenn., Chattanooga—Chattanooga Stamping & Enameling Co., Manufacturers Road, manufacturer of enameled iron stove and refrigerator parts, etc., plans installation of electric power equipment in new one-story addition, about 120 by 800 ft. Cost reported close to $450,000. Work will begin at once. R. H. Hunt Co., Chattanooga Bank Building, is architect.

Tenn., Memphis—Memphis Light, Gas & Water System, 179 Madison Ave., plans new power substation in Millington district, with extensions in transmission and distributing lines. Entire project will cost about $185,000, of which approximately $87,600 will be secured through Federal aid.

Texas, Freeport—Dow Chemical Co., Midland, Mich., plans installation of electric power equipment in new multi-unit synthetic ammonia plant in vicinity of Freeport. Project will include a boiler house and power substation, and is estimated to cost approximately $11,000,000. Financing will be provided by Defense Plant Corp., entire output to be used by Government. Work is scheduled to begin soon.

Texas, Texas City—Pan-American Refining Co., plans installation of power equipment, steel storage tanks, pumping machinery and other mechanical equipment in connection with rebuilding of local oil refining plant, recently destroyed by fire with loss reported over $500,000.

Wis., Brooklyn—Bowman Dairy Co., 140 W. Ontario St., Chicago, Ill., plans installation of new water treatment plant at milk products and dairy properties at Brooklyn, with installation of filters, three pumping units and auxiliary equipment. W. G. Kirchoffer, 22 N. Carroll St., Madison, Wis., is consulting engineer.

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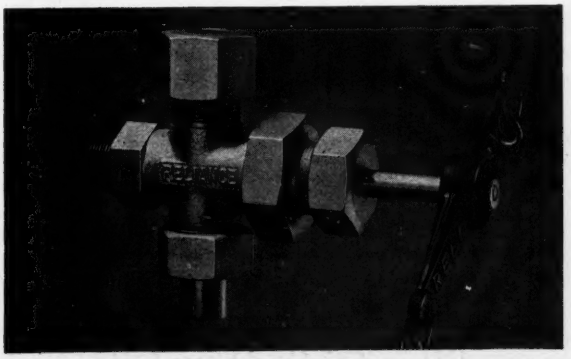

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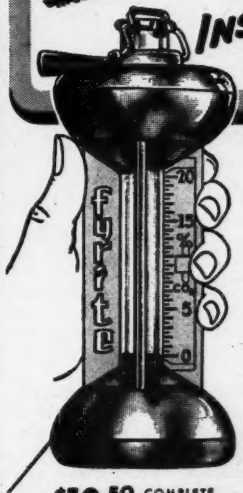

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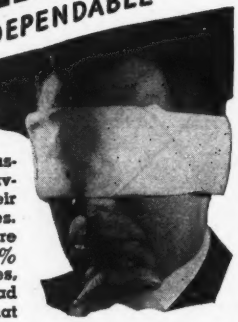

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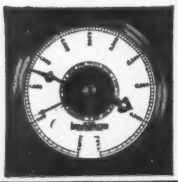

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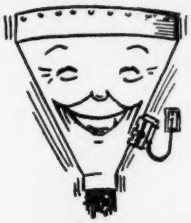

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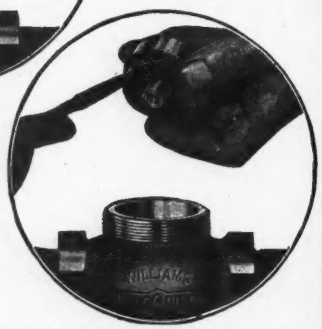

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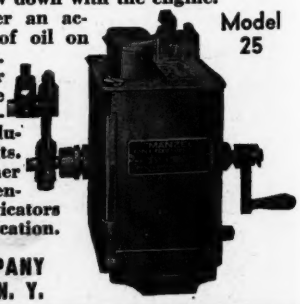

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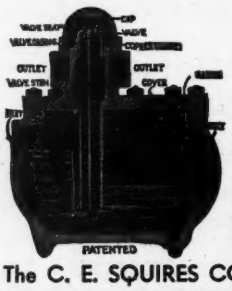

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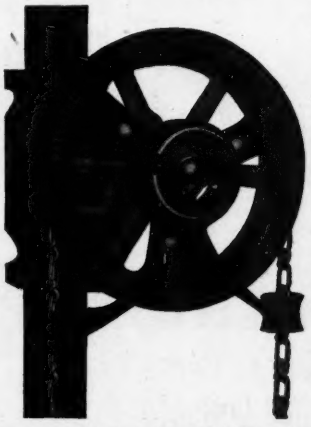
LADDER WORK



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with Chain Guide

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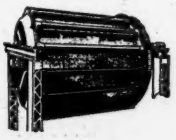

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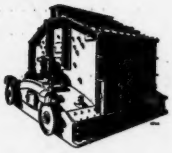

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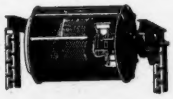

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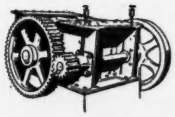

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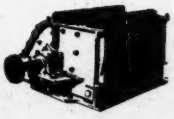

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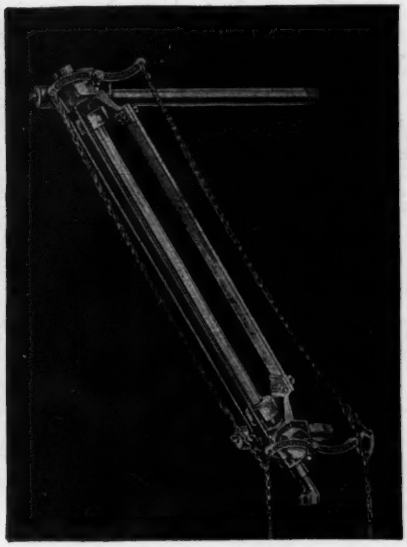

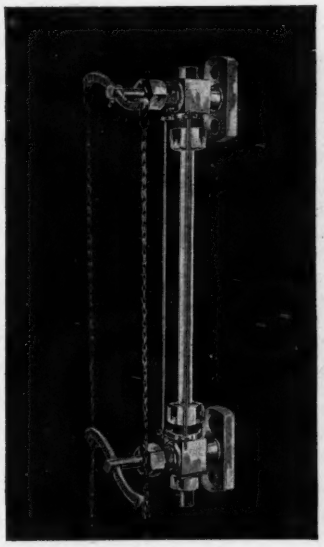

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Vertical—Tiltview

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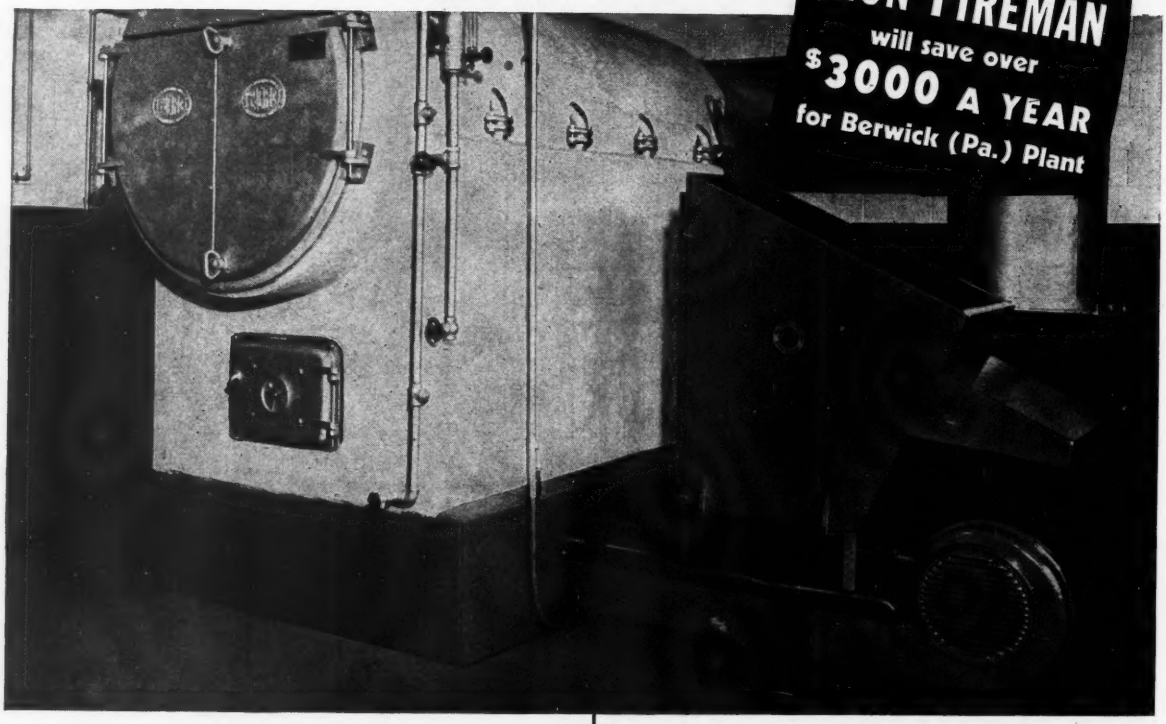
401 N. Broad St., Philadelphia, Pa.

Pennsylvania Plant Changes to Coal



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Charles C. Hertel, Jr.

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List 960

Chapman Small Gate Valves

...with Specially Super-Hardened seats and wedges

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CHICAGO, OCTOBER, 1942

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